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Signed Stephen Hordley

Dated 4 August 2003

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1/77

14JUL03 E822169-1 D02029
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Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

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1. Your reference — SCH/DAB/P33098P1

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2. Patent application number
(The Patent Office will fill in his part) — 0316332.6 — 11 JUL 2003

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3. Full name, address and postcode of the or of each applicant *(underline all surnames)*
Glaxo Group Limited
Glaxo Wellcome House, Berkeley Avenue,
Greenford, Middlesex UB6 0NN, Great Britain

Patents ADP number *(if you know it)* — 473587003

If the applicant is a corporate body, give the country/state of its incorporation — United Kingdom

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4. Title of the invention — Novel Compounds

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5. Name of your agent *(if you have one)* — Corporate Intellectual Property

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*
GlaxoSmithKline
Corporate Intellectual Property (CN9 25.1)
980 Great West Road
BRENTFORD
Middlesex TW8 9GS

Patents ADP number *(if you know it)* — 8072555006

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6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

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7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer yes if:*
   a) any applicant named in part 3 is not an inventor, or
   b) there is an inventor who is named as an applicant, or
   c) any named applicant is a corporate body
   See note (d)

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Continuation sheets of this form	
Description	49
Claim(s)	2
Abstract	
Drawings	

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10. If you are also filing any of the following, state how many against each item.

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Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

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11. We request the grant of a patent on the basis of this application

Signature ____________ Date 10-Jul-03

S C Hockley

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12. Name and daytime telephone number of person to contact in the United Kingdom — S C Hockley 01279 644355

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Notes

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Compounds

The present invention relates to novel pyrimidine derivatives, pharmaceutical compositions containing these compounds and their use in the treatment of diseases, particularly pain, which diseases are caused directly or indirectly by an increase or decrease in activity of the cannabinoid receptor.

Cannabinoids are a specific class of psychoactive compounds present in Indian cannabis (*Cannabis sativa*), including about sixty different molecules, the most representative being cannabinol, cannabidiol and several isomers of tetrahydrocannabinol. Knowledge of the therapeutic activity of cannabis dates back to the ancient dynasties of China, where, 5,000 years ago, cannabis was used for the treatment of asthma, migraine and some gynaecological disorders. These uses later became so established that, around 1850, cannabis extracts were included in the US Pharmacopaeia and remained there until 1947.

Cannabinoids are known to cause different effects on various systems and/or organs, the most important being on the central nervous system and on the cardiovascular system. These effects include alterations in memory and cognition, euphoria, and sedation. Cannabinoids also increase heart rate and vary systemic arterial pressure. Peripheral effects related to bronchial constriction, immunomodulation, and inflammation have also been observed. The capability of cannabinoids to reduce intraocular pressure and to affect respiratory and endocrine systems is also well documented. See e.g. L.E. Hollister, Health Aspects of Cannabis, Pharmacological Reviews, Vol. 38, pp. 1-20, (1986). More recently, it was found that cannabinoids suppress the cellular and humoral immune responses and exhibit antiinflammatory properties. Wirth et al., Antiinflammatory Properties of Cannabichrome, Life Science, Vol. 26, pp. 1991-1995, (1980).

In spite of the foregoing benefits, the therapeutic use of cannabis is controversial, both due to its relevant psychoactive effects (causing dependence and addiction), and due to manifold side effects that have not yet been completely clarified. Although work in this field has been ongoing since the 1940's, evidence indicating that the peripheral effects of cannabinoids are directly mediated, and not secondary to a CNS effect, has been limited by the lack of receptor characterization, the lack of information concerning an endogenous cannabinoid ligand and, until recently, the lack of receptor subtype selective compounds.

The first cannabinoid receptor was found to be mainly located in the brain, in neural cell lines, and, only to a lesser extent, at the peripheral level. In view of its location, it was called the central receptor ("CB1"). See Matsuda et al., "Structure of a Cannabinoid Receptor and Functional Expression of the Cloned cDNA," Nature, Vol. 346, pp. 561-564 (1990. The second cannabinoid receptor ("CB2") was identified in the spleen, and was assumed to modulate the non psychoactive effects of the cannabinoids. See Munro et el., "Molecular Characterization of a Peripheral Receptor for Cannabinoids," Nature, Vol. 365, pp. 61-65 (1993).

Recently, some compounds have been prepared which are capable of acting as agonists on both the cannabinoid receptors. For example, use of derivatives of dihydroxypyrrole-(1,2,3-d,e)-1,4-benzoxazine in the treatment of glaucoma and the use of derivatives of 1,5-diphenyl-pyrazole as immunomodulators or psychotropic agents in the treatment of various neuropathologies, migraine, epilepsy, glaucoma, etc are known. See U.S. Patent No. 5,112,820

and EP 576357, respectively. However, because these compounds are active on both the CB1 and CB2 receptor, they can lead to serious psychoactive effects.

The foregoing indications and the preferential localization of the CB2 receptor in the immune system confirms a specific role of CB2 in modulating the immune and antiinflammatory response to stimuli of different sources.

The total size of the patient population suffering from pain is vast (almost 300 million), dominated by those suffering from back pain, osteo-arthritic pain and post-operative pain. Neuropathic pain (associated with neuronal lesions such as those induced by diabetes, HIV, herpes infection, or stroke) occurs with lower, but still substantial prevalence, as does cancer pain.

The pathogenic mechanisms that give rise to pain symptoms can be grouped into two main categories:

- those that are components of inflammatory tissue responses (Inflammatory Pain):
- those that result from a neuronal lesion of some form (Neuropathic Pain).

Chronic inflammatory pain consists predominantly of osteoarthritis, chronic low back pain and rheumatoid arthritis. The pain results from acute and on-going injury and/or inflammation. There may be both spontaneous and provoked pain.

There is an underlying pathological hypersensitivity as a result of physiological hyperexcitability and the release of inflammatory mediators which further potentiate this hyperexcitability. CB2 receptors are expressed on inflammatory cells (T cells, B cells, macrophages, mast cells) and mediate immune suppression through inhibition of cellular interaction/ inflammatory mediator release. CB2 receptors may also be expressed on sensory nerve terminals and therefore directly inhibit hyperalgesia.

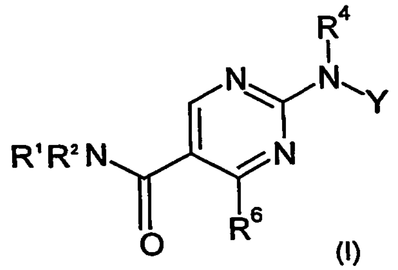
The role of CB2 in immunomodulation, inflammation, osteoporosis, cardiovascular, renal and other disease conditions is now being examined. In light of the fact that cannabinoids act on receptors capable of modulating different functional effects, and in view of the low homology between CB2 and CB1, the importance of developing a class of drugs selective for the specific receptor sub-type is evident. The natural or synthetic cannabinoids currently available do not fulfil this function because they are active on both receptors.

Based on the foregoing, there is a need for compounds which are capable of selectively modulating the receptor for cannabinoids and, therefore, the pathologies associated with such receptors. Thus, CB2 modulators offer a unique approach toward the pharmacotherapy of immune disorders, inflammation, osteoporosis, renal ischemia and other pathophysiological conditions.

The present invention provides novel pyrimidine derivatives of formula (I) and pharmaceutically acceptable derivatives thereof, pharmaceutical compositions containing these compounds or derivatives, and their use as CB2 receptor modulators, which are useful in the treatment of a variety of disorders.

The present invention further comprises a method for treating disease mediated by CB2 receptors in an animal, including humans, which comprises administering to an animal in need thereof an effective amount of a compound of formula (I) or a pharmaceutically acceptable derivative thereof.

The invention provides compounds of formula (I):



(I)

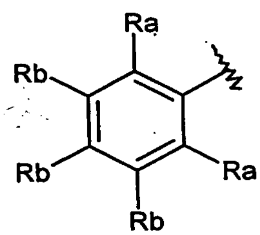
wherein:

Y is phenyl, substituted with one, two or three substituents;

R^1 is selected from: hydrogen, C_{1-6} alkyl, C_{3-7} cycloalkyl, or halosubstitutedC_{1-6} alkyl;

R^2 is $C(R^7)_2R^3$;

R^3 is an optionally substituted 5- to 6- membered aromatic heterocyclyl group, or group A:



(A)

R^4 is selected from: hydrogen, C_{1-6} alkyl, C_{3-7} cycloalkyl, or halosubstitutedC_{1-6} alkyl, $COCH_3$, or SO_2Me;

R^6 is methyl, chloro or CHxFn wherein n is 1, 2, or 3, x is 0, 1 or 2 and n and x add up to 3;

Ra can be independently selected from hydrogen, fluoro, chloro or trifluoromethyl;

Rb can be independently be selected from hydrogen, C_{1-6} alkyl, C_{1-6} alkoxy, haloC_{1-6} alkoxy, hydroxy, cyano, halo, sulfonyl, $CONH_2$, COOH or NHCOOC_{1-6}alkyl;

R^7 can be independently hydrogen or C_{1-6} alkyl;

and pharmaceutically acceptable derivatives thereof;

with the proviso that the compounds are not

2-(4-*tert*-butyl-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid benzylamide;

2-(4-*tert*-butyl-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid benzyl-methyl-amide;

2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 2-methoxy-benzylamide;

2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 2-bromo-benzylamide.

Preferably Y is substituted by 1 or 2 substituents. If mono- substituted, preferably the substituents is in the 3 position; if disubstituted preferably the substituents are in the 2,4-positions.

Substituents for Y are selected from: C_{1-6} alkyl, halosubstitutedC_{1-6} alkyl, C_{1-6} alkoxy, hydroxy group, cyano group, halo, C_{1-6}alkyl sulfonyl group, or COOH. Furthermore the substituent or substituents can be selected from halosubstituted C_{1-6} alkoxy, $SO_2NR^{8a}R^{8b}$ wherein R^{8a} and R^{8b} are independently selected from H or C_{1-6}alkyl as defined above, $CONH_2$, -$NHCOC_{1-6}$alkyl, or CH_2COOH.

Preferably Y is substituted by halo, cyano or methoxy.

Preferably R^1 is hydrogen or C_{1-6}alkyl, more preferably hydrogen.

Preferably R^4 is C_{1-6} alkyl or hydrogen, more preferably methyl or hydrogen, even more preferably hydrogen.

Preferably R^2 is CH_2R^3.

Preferably R^3 is group A, pyridinyl, or pyrimidinyl, any of which can be optionally substituted.

When R^3 is a substituted 5- to 6- membered aromatic heterocyclyl group, the substituent or substituents is/are preferably selected from: C_{1-6} alkyl, C_{1-6} alkoxy, haloC_{1-6} alkoxy, hydroxy, cyano, halo, sulfonyl, $CONH_2$, or COOH. Additionally the substituent(s) can be selected from methylsulfonyl, $NR^{8a}R^{8b}$ wherein R^{8a} and R^{8b} are independently selected from H or C_{1-6}alkyl, $NCOCH_3$, (=O) or $CONHCH_3$. Preferably the halo is fluoro.

Preferred substituents when R^3 is an 5- to 6- membered aromatic heterocyclyl group are halo, methoxy, and cyano.

Alternatively Rb can be independently be selected from hydrogen, C_{1-6} alkyl, C_{1-6} alkoxy, haloC_{1-6} alkoxy, hydroxy, cyano, halo, sulfonyl, $CONH_2$, or COOH.

Preferably Rb is selected from hydrogen, halo, methoxy, and cyano.

Preferably R^6 is $CHxFn$, more preferably CF_3.

We have found that at least in the CB2 assay described herein the following compounds are inactive;

2-(4-*tert*-butyl-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid benzylamide;

2-(4-*tert*-butyl-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid benzyl-methyl-amide;

2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 2-methoxy-benzylamide;

2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 2-bromo-benzylamide.

Preferably the compounds are selective for CB2 over CB1. More preferably the compounds are 100 fold selective, or have less than 10% efficacy at the CB1 receptor.

The invention is described using the following definitions unless otherwise indicated.

The term "pharmaceutically acceptable derivative" means any pharmaceutically acceptable salt, ester, salt of such ester or solvate of the compounds of formula (I), or any other compound which upon administration to the recipient is capable of providing (directly or indirectly) a compound of formula (I) or an active metabolite or residue thereof.

It will be appreciated by those skilled in the art that compounds of formula (I) may be modified to provide pharmaceutically acceptable derivatives thereof at any of the functional groups in the compounds, and that the compounds of formula (I) may be derivatised at more than one position.

It will be appreciated that, for pharmaceutical use, the salts referred to above will be physiologically acceptable salts, but other salts may find use, for example in the preparation of compounds of formula (I) and the physiological acceptable salts thereof. Pharmaceutically acceptable salts include those described by Berge, Bighley and Monkhouse , J. Pharm. Sci., 1977, 66, 1-19. The term "pharmaceutically acceptable salts" refers to salts prepared from pharmaceutically acceptable non-toxic bases including inorganic bases and organic bases. Salts derived from inorganic bases include aluminum, ammonium, calcium, copper, ferric, ferrous, lithium, magnesium, manganic salts, manganous, potassium, sodium, zinc, and the like. Salts derived from pharmaceutically acceptable organic non-toxic bases include salts of primary, secondary, and tertiary amines, substituted amines including naturally occurring substituted amines, cyclic amines, and basic ion exchange resins, such as arginine, betaine, caffeine, choline, N,N'-dibenzylethylenediamine, diethylamine, 2-diethylaminoethanol, 2-dimethylaminoethanol, ethanolamine, ethylenediamine, N-ethyl-morpholine, N-ethylpiperidine, glucamine, glucosamine, histidine, hydrabamine, isopropylamine, lysine, methylglucamine, morpholine, piperazine, piperidine, polyamine resins, procaine, purines, theobromine, triethylamine, trimethylamine, tripropyl amine, tromethamine, and the like. When the compound of the present invention is basic, salts may be prepared from pharmaceutically acceptable non-toxic acids, including inorganic and organic acids. Such acids include acetic, benzenesulfonic, benzoic, camphorsulfonic, citric, ethanesulfonic, fumaric, gluconic, glutamic, hydrobromic, hydrochloric, isethionic, lactic, maleic, malic, mandelic, methanesulfonic, mucic, nitric, pamoic, pantothenic, phosphoric, succinic, sulfuric, tartaric, p-toluenesulfonic acid, and the like.

Preferred examples of pharmaceutically acceptable salts include the ammonium, calcium, magnesium, potassium, and sodium salts, and those formed from maleic, fumaric, benzoic, ascorbic, pamoic, succinic, hydrochloric, sulfuric, bismethylenesalicylic, methanesulfonic, ethanedisulfonic, propionic, tartaric, salicylic, citric, gluconic, aspartic, stearic, palmitic, itaconic, glycolic, p-aminobenzoic, glutamic, benzenesulfonic, cyclohexylsulfamic, phosphoric and nitric acids.

The terms 'halogen or halo' are used to represent fluorine, chlorine, bromine or iodine.

The term 'alkyl' as a group or part of a group means a straight or branched chain alkyl group or combinations thereof, for example a methyl, ethyl, n-propyl, i-propyl, n-butyl, s-butyl, t-butyl, pentyl, hexyl, 1,1-dimethylethyl, or combinations thereof.

The term 'alkoxy' as a group or as part of a group means a straight, branched or cyclic chain alkyl group having an oxygen atom attached to the chain, for example a methoxy, ethoxy, n-propoxy, i-propoxy, n-butoxy, s-butoxy, t-butoxy group, pentoxy, hexyloxy group, cyclopentoxy or cyclohexyloxy group.

The term 'cycloalkyl' means a closed 3- to 7- membered non-aromatic ring, for example cyclobutyl, cyclopentyl, cyclohexyl or cycloheptyl

The term 'aryl' means a 5- or 6- membered aromatic ring, for example phenyl, or a 7- to 12-membered bicyclic ring system where at least one of the rings is aromatic, for example naphthyl.

When R^3 is an optionally substituted aromatic heterocyclyl group, the ring may contain 1, 2, 3, or 4 hetero atoms. Preferably the hetero atoms are selected from oxygen, nitrogen or

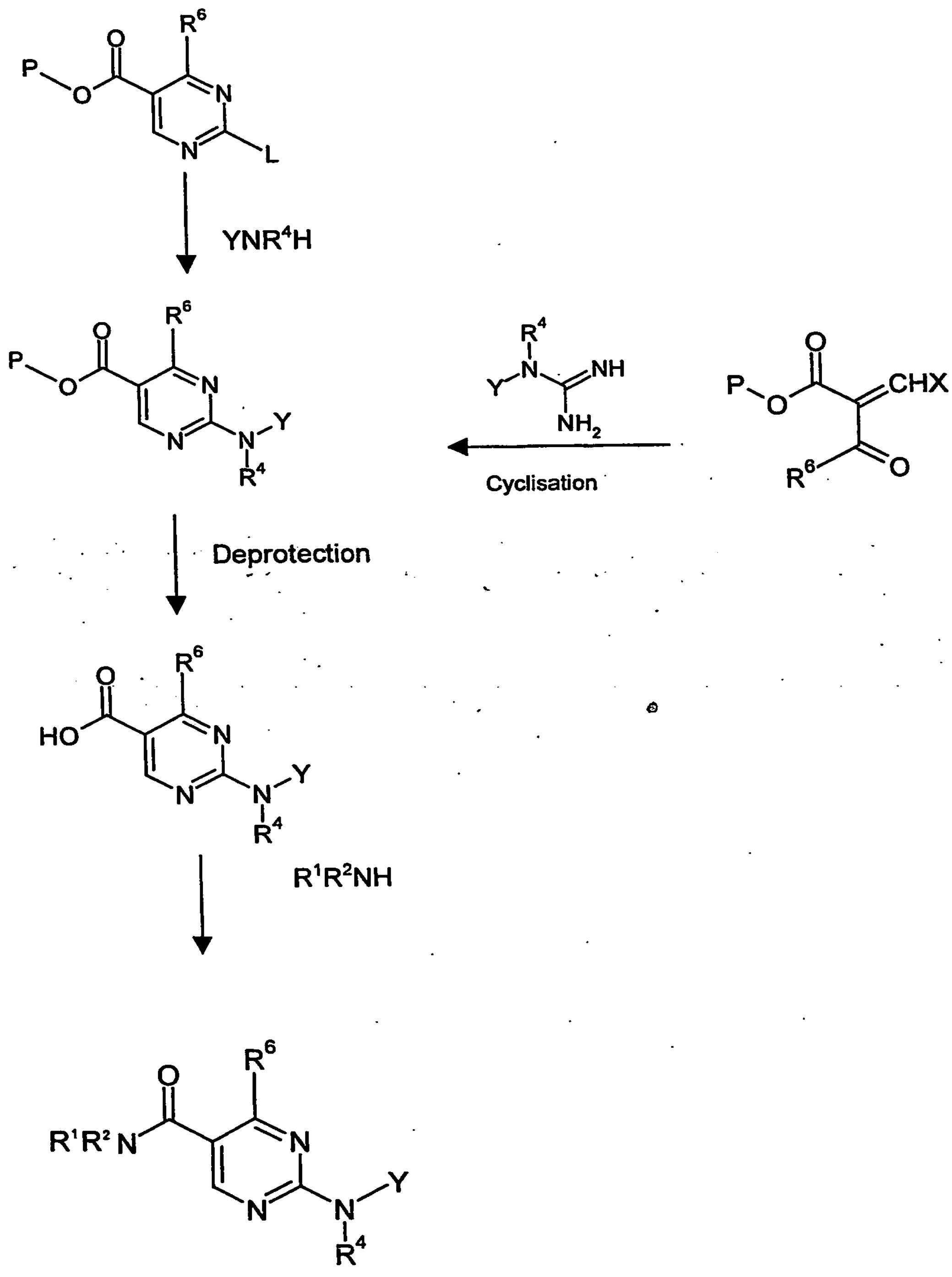
sulphur. Examples of 5- membered heterocyclyl groups in this instance include furanyl, dioxalanyl, pyrrolyl, oxazolyl, thiazolyl, imidazolyl, oxadiazolyl, thiadiazolyl, triazolyl, triazinyl, isothiazolyl, isoxazolyl, thienyl, pyrazolyl or tetrazolyl. Examples of 6-membered heterocyclyl groups are pyridinyl, pyrizinyl, pyrimidinyl, pyrazinyl, triazinyl, or tetrazinyl.

Preferred compounds of the present invention can be selected from:

2-(3-Chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid benzyl-amide;
2-(3-Chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (pyridin-4-ylmethyl)amide;
2-(3-Chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid N-benzyl-N-methylamide;
2-(3-Chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid 4-methoxybenzyl-amide;
2-(3-Chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid 4-fluorobenzyl-amide;
2-(3-Chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid 4-cyanobenzyl-amide;
2-(2,3-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid N-benzyl-N-methylamide;
2-(2,4-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid benzyl-amide;
2-(3,4-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid benzyl-amide;
2-(2,6-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid N-benzyl-N-methylamide;
2-(3,5-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid benzyl-amide;
2-(3-Fluorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid benzyl-amide;
2-(3-Bromophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid benzyl-amide;
2-(3-Bromophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid N-benzyl-N-methylamide;
2-(2-Methoxyphenylamino)-4-trifluoromethylpyrimidine-5-carboxylic aeid benzyl-amide;
2-(2,3-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (pyridin-4-ylmethyl)amide;
2-(2,4-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (pyridin-4-ylmethyl)amide;
2-(3,4-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (pyridin-4-ylmethyl)amide;
2-(2,5-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (pyridin-4-ylmethyl)amide;
2-(3-Fluorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (pyridin-4-ylmethyl)amide;
2-(3-Bromophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (pyridin-4-ylmethyl)amide;
2-(3,5-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (pyridin-4-ylmethyl)amide;
2-(3-Fluorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid 4-fluorobenzyl-amide;
2-(3-Bromophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid 4-fluorobenzyl-amide;

2-(3,5-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid 4-fluorobenzylamide;
2-(3,5-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid 4-cyanobenzyl-amide;
2-(4-Cyano-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid benzylamide;
2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (2-methyl-pyridin-4-ylmethyl)-amide hydrochloride;
2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (2-fluoro-pyridin-4-ylmethyl)-amide;
and pharmaceutically acceptable derivatives thereof.

Compounds of formula (I) can be prepared as set forth in the following scheme:



wherein L is a leaving group, for example halo, P is a protecting group for example methyl, ethyl or benzyl, X is a leaving group, for example halo, OC_{1-6} alkyl eg O-methyl or O-ethyl or NR^cR^d wherein R^c and R^d are independently selected from C_{1-6} alkyl eg methyl and R^1, R^2, R^4, R^6 and Y are as defined for compounds of formula (I).

It is to be understood that the present invention encompasses all isomers of compounds of formula (I) and their pharmaceutically acceptable derivatives, including all geometric, tautomeric and optical forms, and mixtures thereof (e.g. racemic mixtures). Where additional chiral centres are present in compounds of formula (I), the present invention includes within its scope all possible diastereoismers, including mixtures thereof. The different isomeric forms may be separated or resolved one from the other by conventional methods, or any given isomer may be obtained by conventional synthetic methods or by stereospecific or asymmetric syntheses.
The subject invention also includes isotopically-labeled compounds, which are identical to those recited in formulas I and following, but for the fact that one or more atoms are replaced by an atom having an atomic mass or mass number different from the atomic mass or mass number usually found in nature. Examples of isotopes that can be incorporated into compounds of the invention include isotopes of hydrogen, carbon, nitrogen, oxygen, phosphorous, fluorine, iodine, and chlorine, such as ^{3}H, ^{11}C, ^{14}C, ^{18}F, ^{123}I and ^{125}I.

Compounds of the present invention and pharmaceutically acceptable salts of said compounds that contain the aforementioned isotopes and/or other isotopes of other atoms are within the scope of the present invention. Isotopically-labeled compounds of the present invention, for example those into which radioactive isotopes such as ^{3}H, ^{14}C are incorporated, are useful in drug and/or substrate tissue distribution assays. Tritiated, i.e., ^{3}H, and carbon-14, i.e., ^{14}C, isotopes are particularly preferred for their ease of preparation and detectability. ^{11}C and ^{8}F isotopes are particularly useful in PET (positron emission tomography), and ^{125}I isotopes are particularly useful in SPECT (single photon emission computerized tomography), all useful in brain imaging. Further, substitution with heavier isotopes such as deuterium, i.e., ^{2}H, can afford certain therapeutic advantages resulting from greater metabolic stability, for example increased *in vivo* half-life or reduced dosage requirements and, hence, may be preferred in some circumstances. Isotopically labeled compounds of formula I and following of this invention can generally be prepared by carrying out the procedures disclosed in the Schemes and/or in the Examples below, by substituting a readily available isotopically labeled reagent for a non-isotopically labeled reagent.

The compounds of formula (I) may be prepared in crystalline or non-crystalline form, and, if crystalline, may optionally be hydrated or solvated. This invention includes within its scope stoichiometric hydrates or solvates as well as compounds containing variable amounts of water and/or solvent.

The compounds of the invention bind selectively to the CB2 receptor, and are therefore useful in treating CB2 receptor mediated diseases.

In view of their ability to bind to the CB2 receptor, the compounds of the invention may be useful in the treatment of the disorders that follow. Thus, the compounds of formula (I) may be useful as analgesics. For example they may be useful in the treatment of chronic inflammatory pain (e.g. pain associated with rheumatoid arthritis, osteoarthritis, rheumatoid spondylitis, gouty arthritis and juvenile arthritis) including the property of disease modification and joint structure preservation; musculoskeletal pain; lower back and neck pain; sprains and strains; neuropathic pain; sympathetically maintained pain; myositis; pain associated with cancer and fibromyalgia; pain associated with migraine; pain associated with influenza or other viral infections, such as the common cold; rheumatic fever; pain associated with functional bowel disorders such as non-ulcer

dyspepsia, non-cardiac chest pain and irritable bowel syndrome; pain associated with myocardial ischemia; post operative pain; headache; toothache; and dysmenorrhea.

The compounds of the invention may also be useful disease modification or joint structure preservation in multiple sclerosis, rheumatoid arthritis, osteo-arthritis, rheumatoid spondylitis, gouty arthritis and juvenile arthritis.

The compounds of the invention may be particularly useful in the treatment of neuropathic pain. Neuropathic pain syndromes can develop following neuronal injury and the resulting pain may persist for months or years, even after the original injury has healed. Neuronal injury may occur in the peripheral nerves, dorsal roots, spinal cord or certain regions in the brain. Neuropathic pain syndromes are traditionally classified according to the disease or event that precipitated them. Neuropathic pain syndromes include: diabetic neuropathy; sciatica; non-specific lower back pain; multiple sclerosis pain; fibromyalgia; HIV-related neuropathy; post-herpetic neuralgia; trigeminal neuralgia; and pain resulting from physical trauma, amputation, cancer, toxins or chronic inflammatory conditions. These conditions are difficult to treat and although several drugs are known to have limited efficacy, complete pain control is rarely achieved. The symptoms of neuropathic pain are incredibly heterogeneous and are often described as spontaneous shooting and lancinating pain, or ongoing, burning pain. In addition, there is pain associated with normally non-painful sensations such as "pins and needles" (paraesthesias and dysesthesias), increased sensitivity to touch (hyperesthesia), painful sensation following innocuous stimulation (dynamic, static or thermal allodynia), increased sensitivity to noxious stimuli (thermal, cold, mechanical hyperalgesia), continuing pain sensation after removal of the stimulation (hyperpathia) or an absence of or deficit in selective sensory pathways (hypoalgesia).

The compounds of formula (I) may also be useful in the treatment of fever.

The compounds of formula (I) may also be useful in the treatment of inflammation, for example in the treatment of skin conditions (e.g. sunburn, burns, eczema, dermatitis, psoriasis); ophthalmic diseases such as glaucoma, retinitis, retinopathies, uveitis and of acute injury to the eye tissue (e.g. conjunctivitis); lung disorders (e.g. asthma, bronchitis, emphysema, allergic rhinitis, respiratory distress syndrome, pigeon fancier's disease, farmer's lung, chronic obstructive pulmonary disease, (COPD); gastrointestinal tract disorders (e.g. aphthous ulcer, Crohn's disease, atopic gastritis, gastritis varialoforme, ulcerative colitis, coeliac disease, regional ileitis, irritable bowel syndrome, inflammatory bowel disease, gastrointestinal reflux disease); organ transplantation; other conditions with an inflammatory component such as vascular disease, migraine, periarteritis nodosa, thyroiditis, aplastic anaemia, Hodgkin's disease, sclerodoma, myaesthenia gravis, multiple sclerosis, sorcoidosis, nephrotic syndrome, Bechet's syndrome, polymyositis, gingivitis, myocardial ischemia, pyrexia, systemic lupus erythematosus, tendinitis, bursitis, and Sjogren's syndrome.

The compounds of formula (I) are also useful in the treatment of immunological diseases such as autoimmune diseases, immunological deficiency diseases or organ transplantation. The compounds of formula (I) are also effective in increasing the latency of HIV infection.

The compounds of formula (I) are also useful in the treatment of diseases of abnormal platelet function (e.g. occlusive vascular diseases).

The compounds of formula (I) are also useful for the preparation of a drug with diuretic action.

The compounds of formula (I) are also useful in the treatment of impotence or erectile dysfunction.

The compounds of formula (I) are also useful for attenuating the hemodynamic side effects of non-steroidal anti-inflammatory drugs (NSAID's) and cyclooxygenase-2 (COX-2) inhibitors.

The compounds of formula (I) are also useful in the treatment of neurodegenerative diseases and neurodegeneration such as dementia, particularly degenerative dementia (including senile dementia, Alzheimer's disease, Pick's disease, Huntingdon's chorea, Parkinson's disease and Creutzfeldt-Jakob disease, motor neuron disease); vascular dementia (including multi-infarct dementia); as well as dementia associated with intracranial space occupying lesions; trauma; infections and related conditions (including HIV infection); dementia in Parkinson's disease, metabolism; toxins; anoxia and vitamin deficiency; and mild cognitive impairment associated with ageing, particularly Age Associated Memory Impairment. The compounds may also be useful for the treatment of amyotrophic lateral sclerosis (ALS) and neuroinflamation.

The compounds of formula (I) are also useful in neuroprotection and in the treatment of neurodegeneration following stroke, cardiac arrest, pulmonary bypass, traumatic brain injury, spinal cord injury or the like.

The compounds of formula (I) are also useful in the treatment of tinnitus.

The compounds of formula (I) are also useful in the treatment of psychiatric disease for example schizophrenia, depression (which term is used herein to include bipolar depression, unipolar depression, single or recurrent major depressive episodes with or without psychotic features, catatonic features, melancholic features, atypical features or postpartum onset, seasonal affective disorder, dysthymic disorders with early or late onset and with or without atypical features, neurotic depression and social phobia, depression accompanying dementia for example of the Alzheimer's type, schizoaffective disorder or the depressed type, and depressive disorders resulting from general medical conditions including, but not limited to, myocardial infarction, diabetes, miscarriage or abortion, *etc*), anxiety disorders (including generalised anxiety disorder and social anxiety disorder), panic disorder, agoraphobia, social phobia, obsessive compulsive disorder and post-traumatic stress disorder, memory disorders, including dementia, amnesic disorders and age-associated memory impairment, disorders of eating behaviours, including anorexia nervosa and bulimia nervosa, sexual dysfunction, sleep disorders (including disturbances of circadian rhythm, dyssomnia, insomnia, sleep apnea and narcolepsy), withdrawal from abuse of drugs such as of cocaine, ethanol, nicotine, benzodiazepines, alcohol, caffeine, phencyclidine (phencyclidine-like compounds), opiates (e.g. cannabis, heroin, morphine), amphetamine or amphetamine-related drugs (e.g. dextroamphetamine, methylamphetamine) or a combination thereof.

The compounds of formula (I) are also useful in preventing or reducing dependence on, or preventing or reducing tolerance or reverse tolerance to, a dependence - inducing agent. Examples of dependence inducing agents include opioids (e.g. morphine), CNS depressants (e.g. ethanol), psychostimulants (e.g. cocaine) and nicotine.

The compounds of formula (I) are also useful in the treatment of kidney dysfunction (nephritis, particularly mesangial proliferative glomerulonephritis, nephritic syndrome), liver dysfunction (hepatitis, cirrhosis), gastrointestinal dysfunction (diarrhoea) and colon cancer.

It is to be understood that references to treatment includes both treatment of established symptoms and prophylactic treatment unless explicitly stated otherwise.

According to a further aspect of the invention, we provide a compound of formula (I) or a pharmaceutically acceptable derivative thereof for use in human or veterinary medicine.

According to another aspect of the invention, we provide a compound of formula (I) or a pharmaceutically acceptable derivative thereof for use in the treatment of a condition which is mediated by the activity of cannabinoid 2 receptors.

According to a further aspect of the invention, we provide a method of treating a human or animal subject suffering from a condition which is mediated by the activity of cannabinoid 2 receptors which comprises administering to said subject a therapeutically effective amount of a compound of formula (I) or a pharmaceutically acceptable derivative thereof.

According to a further aspect of the invention we provide a method of treating a human or animal subject suffering from an immune disorder, an inflammatory disorder, pain, rheumatoid arthritis, multiple sclerosis, osteoarthritis or osteoporosis which method comprises administering to said subject an effective amount of a compound of formula (I) or a pharmaceutically acceptable derivative thereof.

Preferably the pain is selected from inflammatory pain, viseral pain, cancer pain, neuropathic pain, lower back pain, muscular sceletal, post operative pain, acute pain and migraine. More preferably the inflammatory pain is pain associated with rheumatoid arthritis or osteoarthritis.

According to another aspect of the invention is provided the use of a compound of formula (I) or a pharmaceutically acceptable derivative thereof for the manufacture of a therapeutic agent for the treatment or prevention of a condition such an immune disorder, an inflammatory disorder, pain, rheumatoid arthritis, multiple sclerosis, osteoarthritis or osteoporosis which method comprises administering to said subject an effective amount of a compound of formula (I) or a pharmaceutically acceptable derivative thereof.

In order to use a compound of formula (I) or a pharmaceutically acceptable derivative thereof for the treatment of humans and other mammals it is normally formulated in accordance with standard pharmaceutical practice as a pharmaceutical composition. Therefore in another aspect of the invention is provided a pharmaceutical composition comprising a compound of formula (I) or a pharmaceutically acceptable derivative thereof adapted for use in human or veterinary medicine.

As used herein, "modulator" means both antagonist, partial agonist and a full agonist, and inverse agonist. Preferably the present modulators are agonists.

Compounds of formula (I) and their pharmaceutically acceptable derivatives may be administered in a standard manner for the treatment of the indicated diseases, for example orally, parentarally, sub-lingually, dermally, intranasally, transdermally, rectally, via inhalation or via buccal administration.

Compositions of formula (I) and their pharmaceutically acceptable derivatives which are active when given orally can be formulated as syrups, tablets, capsules and lozenges. A syrup

formulation will generally consist of a suspension or solution of the compound or salt in a liquid carrier for example, ethanol, peanut oil, olive oil, glycerine or water with a flavouring or colouring agent. Where the composition is in the form of a tablet, any pharmaceutical carrier routinely used for preparing solid formulations may be used. Examples of such carriers include magnesium stearate, terra alba, talc, gelatin, acacia, stearic acid, starch, lactose and sucrose. Where the composition is in the form of a capsule, any routine encapsulation is suitable, for example using the aforementioned carriers in a hard gelatin capsule shell. Where the composition is in the form of a soft gelatin shell capsule any pharmaceutical carrier routinely used for preparing dispersions or suspensions may be considered, for example aqueous gums, celluloses, silicates or oils, and are incorporated in a soft gelatin capsule shell.

Typical parenteral compositions consist of a solution or suspension of a compound or derivative in a sterile aqueous or non-aqueous carrier optionally containing a parenterally acceptable oil, for example polyethylene glycol, polyvinylpyrrolidone, lecithin, arachis oil or sesame oil.

Typical compositions for inhalation are in the form of a solution, suspension or emulsion that may be administered as a dry powder or in the form of an aerosol using a conventional propellant such as dichlorodifluoromethane or trichlorofluoromethane.

A typical suppository formulation comprises a compound of formula (I) or a pharmaceutically acceptable derivative thereof which is active when administered in this way, with a binding and/or lubricating agent, for example polymeric glycols, gelatins, cocoa-butter or other low melting vegetable waxes or fats or their synthetic analogs.

Typical dermal and transdermal formulations comprise a conventional aqueous or non-aqueous vehicle, for example a cream, ointment, lotion or paste or are in the form of a medicated plaster, patch or membrane.

Preferably the composition is in unit dosage form, for example a tablet, capsule or metered aerosol dose, so that the patient may administer a single dose.

Each dosage unit for oral administration contains suitably from 0.1 mg to 500 mg/Kg, and preferably from 1 mg to 100 mg/Kg, and each dosage unit for parenteral administration contains suitably from 0.1 mg to 100 mg/Kg, of a compound of formula(I) or a pharmaceutically acceptable derivative thereof calculated as the free acid. Each dosage unit for intranasal administration contains suitably 1-400 mg and preferably 10 to 200 mg per person. A topical formulation contains suitably 0.01 to 5.0% of a compound of formula (I).

The daily dosage regimen for oral administration is suitably about 0.01 mg/Kg to 40 mg/Kg, of a compound of formula(I) or a pharmaceutically acceptable derivative thereof calculated as the free acid. The daily dosage regimen for parenteral administration is suitably about 0.001 mg/Kg to 40 mg/Kg, of a compound of formula (I) or a pharmaceutically acceptable derivative thereof calculated as the free acid. The daily dosage regimen for intranasal administration and oral inhalation is suitably about 10 to about 500 mg/person. The active ingredient may be administered from 1 to 6 times a day, sufficient to exhibit the desired activity.

The CB_2 receptor compounds for use in the instant invention may be used in combination with other therapeutic agents, for example COX-2 inhibitors, such as celecoxib, deracoxib, rofecoxib, valdecoxib, parecoxib or COX-189; 5-lipoxygenase inhibitors; NSAID's, such as aspirin, diclofenac, indomethacin, nabumetone or ibuprofen; leukotriene receptor

antagonists; DMARD's such as methotrexate; adenosine A1 receptor agonists; sodium channel blockers, such as lamotrigine; NMDA receptor modulators, such as glycine receptor antagonists; gabapentin and related compounds; tricyclic antidepressants such as amitriptyline; neurone stabilising antiepileptic drugs; mono-aminergic uptake inhibitors such as venlafaxine; opioid analgesics; local anaesthetics; $5HT_1$ agonists, such as triptans, for example sumatriptan, naratriptan, zolmitriptan, eletriptan, frovatriptan, almotriptan or rizatriptan; EP_1 receptor ligands, EP_4 receptor ligands; EP_2 receptor ligands; EP_3 receptor ligands; EP_4 antagonists; EP_2 antagonists and EP_3 antagonists; bradykinin receptor ligands and vanilloid receptor ligand. antirheumatoid arthritis drugs, for example anti TNF drugs e.g. enbrel, remicade, anti-IL-1 drugs, or DMARDS e.g. leflunamide. When the compounds are used in combination with other therapeutic agents, the compounds may be administered either sequentially or simultaneously by any convenient route.

Additional COX-2 inhibitors are disclosed in US Patent Nos. 5,474,995 US5,633,272; US5,466,823, US6,310,099 and US6,291,523; and in WO 96/25405, WO 97/38986, WO 98/03484, WO 97/14691, WO99/12930, WO00/26216, WO00/52008, WO00/38311, WO01/58881 and WO02/18374.

The invention thus provides, in a further aspect, a combination comprising a compound of formula (I) or a pharmaceutically acceptable derivative thereof together with a further therapeutic agent or agents.

Suitable 5HT3 antagonists which may be used in combination of the compound of the inventions include for example ondansetron, granisetron, metoclopramide.

Suitable serotonin agonists which may be used in combination with the compound of the invention include sumatriptan, rauwolscine, yohimbine, metoclopramide.

Suitable SSRIs which may be used in combination with the compound of the invention include fluoxetine, citalopram, femoxetine, fluvoxamine, paroxetine, indalpine, sertraline, zimeldine.

Suitable SNRIs which may be used in combination with the compound of the invention include venlafaxine and reboxetine.

Suitable tricyclic antidepressants which may be used in combination with a compound of the invention include imipramine, amitriptiline, chlomipramine and nortriptiline.

Suitable dopaminergic antidepressants which may be used in combination with a compound of the invention include bupropion and amineptine.

It will be appreciated that the compounds of any of the above combinations or compositions may be administered simultaneously (either in the same or different pharmaceutical formulations), separately or sequentially.

The combinations referred to above may conveniently be presented for use in the form of a pharmaceutical formulation and thus pharmaceutical formulations comprising a combination as defined above together with a pharmaceutically acceptable carrier or excipient comprise a further aspect of the invention. The individual components of such combinations may be administered either sequentially or simultaneously in separate or combined pharmaceutical formulations.

When a compound of formula (I) or a pharmaceutically acceptable derivative thereof is used in combination with a second therapeutic agent active against the same disease state the dose of each compound may differ from that when the compound is used alone. Appropriate doses will be readily appreciated by those skilled in the art.

Determination of cannabinoid CB1 Receptor Agonist Activity

The cannabinoid CB1 receptor agonist activity of the compounds of formula (I) was determined in accordance with the following experimental method.

Experimental Method

Yeast (*Saccharomyces cerevisiae*) cells expressing the human cannabinoid CB1 receptor were generated by integration of an expression cassette into the *ura3* chromosomal locus of yeast strain MMY23. This cassette consisted of DNA sequence encoding the human CB1 receptor flanked by the yeast GPD promoter to the 5' end of CB1 and a yeast transcriptional terminator sequence to the 3' end of CB1. MMY23 expresses a yeast/mammalian chimeric G-protein alpha subunit in which the C-terminal 5 amino acids of Gpa1 are replaced with the C-terminal 5 amino acids of human Gαi3 (as described in Brown *et al.* (2000), *Yeast* **16**:11-22). Cells were grown at 30°C in liquid Synthetic Complete (SC) yeast media (Guthrie and Fink (1991), Methods in Enzymology, Vol. 194) lacking uracil, tryptophan, adenine and leucine to late logarithmic phase (approximately 6 OD_{600}/ml).

Agonists were prepared as 10 mM stocks in DMSO. EC_{50} values (the concentration required to produce 50% maximal response) were estimated using dilutions of between 3- and 5-fold (BiomekFX, Beckman) into DMSO. Agonist solutions in DMSO (1% final assay volume) were transferred into black, clear bottom, microtitre plates from NUNC (96- or 384-well). Cells were suspended at a density of 0.2 OD_{600}/ml in SC media lacking histidine, uracil, tryptophan, adenine and leucine and supplemented with 10mM 3-aminotriazole, 0.1M sodium phosphate pH 7.0, and 20μM fluorescein di-β-D-glucopyranoside (FDGlu). This mixture (50ul per well for 384-well plates, 200ul per well for 96-well plates) was added to agonist in the assay plates (Multidrop 384, Labsystems). After incubation at 30°C for 24 hours, fluorescence resulting from degradation of FDGlu to fluorescein due to exoglucanase, an endogenous yeast enzyme produced during agonist-stimulated cell growth, was determined using a Spectrofluor microtitre plate reader (Tecan; excitation wavelength: 485nm; emission wavelength: 535nm). Fluorescence was plotted against compound concentration and iteratively curve fitted using a four parameter fit to generate a concentration effect value. Efficacy (E_{max}) was calculated from the equation

$$E_{max} = Max_{[compound\ X]} - Min_{[compound\ X]} / Max_{[HU210]} - Min_{[HU210]} \times 100\%$$

where $Max_{[compound\ X]}$ and $Min_{[compound\ X]}$ are the fitted maximum and minimum respectively from the concentration effect curve for compound X, and $Max_{[HU210]}$ and $Min_{[HU210]}$ are the fitted maximum and minimum respectively from the concentration effect curve for (6aR,10aR)-3-(1,1'-Dimethylheptyl)-6a,7,10,10a-tetrahydro-1-hydroxy-6,6-dimethyl-6H-dibenzo[b,d]pyran-9-methanol (HU210; available from Tocris). Equieffective molar ratio (EMR) values were calculated from the equation

$$EMR = EC_{50\ [compound\ X]} / EC_{50\ [HU210]}$$

Where $EC_{50\ [compound\ X]}$ is the EC_{50} of compound X and $EC_{50\ [HU210]}$ is the EC_{50} of HU210.

Compounds of the Examples tested according to this method had EC_{50} values >2000nM and/or efficacy values of <50% at the cloned human cannabinoid CB1 receptor.

Determination of cannabinoid CB2 Receptor Agonist Activity

The cannabinoid CB2 receptor agonist activity of the compounds of formula (I) was determined in accordance with the following experimental method.

Experimental Method

Yeast (*Saccharomyces cerevisiae*) cells expressing the human cannabinoid CB2 receptor were generated by integration of an expression cassette into the *ura3* chromosomal locus of yeast strain MMY23. This cassette consisted of DNA sequence encoding the human CB2 receptor flanked by the yeast GPD promoter to the 5' end of CB2 and a yeast transcriptional terminator sequence to the 3' end of CB2. MMY23 expresses a yeast/mammalian chimeric G-protein alpha subunit in which the C-terminal 5 amino acids of Gpa1 are replaced with the C-terminal 5 amino acids of human $G\alpha i3$ (as described in Brown *et al.* (2000), *Yeast* **16**:11-22). Cells were grown at 30°C in liquid Synthetic Complete (SC) yeast media (Guthrie and Fink (1991), Methods in Enzymology, Vol. 194) lacking uracil, tryptophan, adenine and leucine to late logarithmic phase (approximately 6 OD_{600}/ml).

Agonists were prepared as 10 mM stocks in DMSO. EC_{50} values (the concentration required to produce 50% maximal response) were estimated using dilutions of between 3- and 5-fold (BiomekFX, Beckman) into DMSO. Agonist solutions in DMSO (1% final assay volume) were transferred into black, clear bottom, microtitre plates from NUNC (96- or 384-well). Cells were suspended at a density of 0.2 OD_{600}/ml in SC media lacking histidine, uracil, tryptophan, adenine and leucine and supplemented with 10mM 3-aminotriazole, 0.1M sodium phosphate pH 7.0, and 20M fluorescein di-β-D-glucopyranoside (FDGlu). This mixture (50ul per well for 384-well plates, 200ul per well for 96-well plates) was added to agonist in the assay plates (Multidrop 384, Labsystems). After incubation at 30°C for 24 hours, fluorescence resulting from degradation of FDGlu to fluorescein due to exoglucanase, an endogenous yeast enzyme produced during agonist-stimulated cell growth, was determined using a Spectrofluor microtitre plate reader (Tecan; excitation wavelength: 485nm; emission wavelength: 535nm). Fluorescence was plotted against compound concentration and iteratively curve fitted using a four parameter fit to generate a concentration effect value. Efficacy (E_{max}) was calculated from the equation

$$E_{max} = Max_{[compound\ X]} - Min_{[compound\ X]} / Max_{[HU210]} - Min_{[HU210]} \times 100\%$$

where $Max_{[compound\ X]}$ and $Min_{[compound\ X]}$ are the fitted maximum and minimum respectively from the concentration effect curve for compound X, and $Max_{[HU210]}$ and $Min_{[HU210]}$ are the fitted maximum and minimum respectively from the concentration effect curve for (6aR,10aR)-3-(1,1'-Dimethylheptyl)-6a,7,10,10a-tetrahydro-1-hydroxy-6,6-dimethyl-6H-dibenzo[b,d]pyran-9-methanol (HU210; available from Tocris). Equieffective molar ratio (EMR) values were calculated from the equation

$$EMR = EC_{50\ [compound\ X]} / EC_{50\ [HU210]}$$

Where $EC_{50\ [compound\ X]}$ is the EC_{50} of compound X and $EC_{50\ [HU210]}$ is the EC_{50} of HU210.

Compounds of Examples 1 to 29 and 79 to 104 tested according to this method had EC_{50} values 20 to 1000nM and efficacy values of >50% at the cloned human cannabinoid CB2 receptor.

Compounds of Examples 30 to 42 tested according to this method had EC_{50} values > 1000nM or efficacy values of <50% at the cloned human cannabinoid CB2 receptor.

Compounds of Examples 43 to 78 and 105 to 114 tested according to this method had EC_{50} values > 1000nM and efficacy values of <50% at the cloned human cannabinoid CB2 receptor.

The following examples are illustrative, but not limiting of the embodiments of the present invention.

All NMR experimental data was recorded at 400MHz.

Conditions, Hardware, and Software used for Mass-directed Autopurification

Hardware

Waters 600 gradient pump, Waters 2700 sample manager , Waters Reagent Manager, Micromass ZMD mass spectrometer, Gilson 202 - fraction collector, Gilson Aspec - waste collector.

Software

Micromass Masslynx version 3.5

Column

The column used is typically a Supelco ABZ+ column whose dimensions are 10mm internal diameter by 100mm in length. The stationary phase particle size is 5µm.

Solvents

A. Aqueous solvent = Water + 0.1% Formic Acid
B. Organic solvent = MeCN: Water 95:5 +0.05% Formic Acid
Make up solvent = MeOH: Water 80:20 +50mMol Ammonium Acetate
Needle rinse solvent = MeOH: Water: DMSO 80:10:10

Methods

Five methods are used depending on the analytical retention time of the compound of interest. They all have a flow rate of 20ml/min and a 15-minute runtime, which comprises of a 10-minute gradient followed by a 5-minute column flush and re-equilibration step.

Method 1 MDP 1.5-2.2 = 0-30%B
Method 2 MDP 2.0-2.8 = 5-30% B
Method 3 MDP 2.5-3.0 = 15-55%B
Method 4 MDP 2.8-4.0 = 30-80% B
Method 5 MDP 3.8-5.5 = 50-90% B

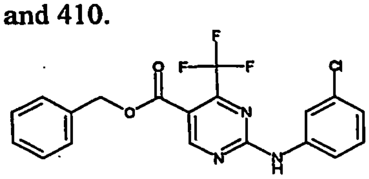
Example 1: 2-(3-Chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid benzyl-amide

(a). To a solution of benzyl 2-chloro-4-trifluoromethylpyrimidine-5-carboxylate (0.50 g, ex Maybridge) in 1,4-dioxan (5 ml) was added 3-chloroaniline (0.85 ml) and the solution stirred at

room temperature for 15 h. 1,4-Dioxan was removed under reduced pressure and ethyl acetate (15 ml) added. The solution was washed sequentially with 2N hydrochloric acid (10 ml) and water (3 x 10 ml), dried ($MgSO_4$), evaporated and triturated with hexane to afford benzyl 2-(3-chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylate (524 mg).

NMR (400MHz, DMSO-d6) δ 5.35 (2H, s), 7.14 (1H, d), 7.35-7.45 (6H, m), 7.68 (1H, m), 7.98 (1H, s), 9.13 (1H, s), 10.95 (1H, s).

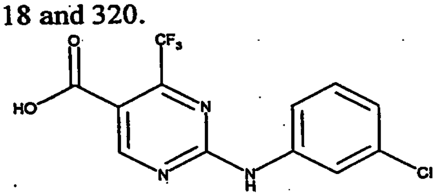
LC/MS, t = 3.70 min, [MH^+] 408 and 410.



(b). To a solution of benzyl 2-(3-chlorophenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylate (0.50 g) in ethanol (15 ml) was added a solution of potassium hydroxide (205 mg) in ethanol (10 ml) and the solution stirred at reflux for 15 h. Ethanol was removed under reduced pressure and water (15 ml) added. The solution was washed with ether and concentrated hydrochloric acid added to adjust the acidity to pH 1. The precipitated solid was filtered, washed with water and dried in vacuo at 50°C to afford 2-(3-chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (366 mg,).

NMR (400MHz, DMSO-d6) δ 7.49 (1H, d), 7.71 (1H, t), 7.98 (1H, d), 8.33 (1H, s), 9.42 (1H, s), 11.15 (1H, s), 14.0 (1H, br s).

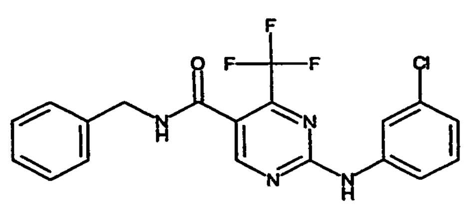
LC/MS, t = 3.44 min, [MH^+] 318 and 320.



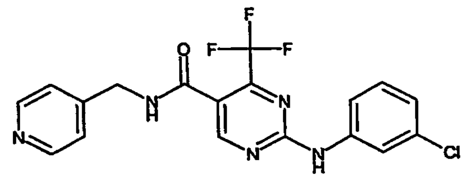
(c). To a solution of 2-(3-chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (35 mg) in dimethylformamide (2 ml) was added successively N-ethylmorpholine (42 μl), benzylamine (15μl), 1-hydroxybenzotriazole hydrate (23 mg) and 1-(3-dimethylamino-propyl)-3-ethylcarbodiimide hydrochloride (25 mg). The solution was stirred for 3 h and allowed to stand overnight. Dimethylformamide was removed under reduced pressure and ethyl acetate (5 ml) added. The solution was washed sequentially with 5% sodium bicarbonate solution (2.5 ml), water (2.5 ml), 5% citric acid solution (2.5 ml) and brine (2 x 2.5 ml), dried ($MgSO_4$) and evaporated to afford the title compound (45 mg).

NMR (400MHz, DMSO-d6) δ 4.47 (2H, d), 7.10 (1H, d), 7.25 (1H, m), 7.36 (5H, m), 7.69 (1H, d), 7.98 (1H, s), 8.89 (1H, s), 9.12 (1H, t), 10.65 (1H, s).

LC/MS, t = 3.23 min, [MH^+] 407 and 409.

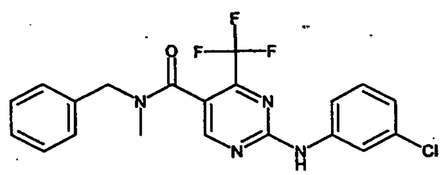


Example 2: 2-(3-Chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (pyridin-4-ylmethyl)amide



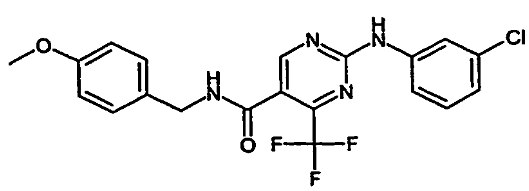
In a manner similar to Example 1(c) 2-(3-chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (35 mg) and 4-(aminomethyl)pyridine (13.5 µl) afforded the title compound (32 mg).
NMR (400MHz, DMSO-d6) δ 4.48 (2H, d), 7.10 (1H, d), 7.37 (3H, m), 7.69 (1H, d), 7.98 (1H, s), 8.55 (2H, d), 8.97 (1H, s), 9.26 (1H, t), 10.65 (1H, s).
LC/MS, t = 2.90 min, [MH^+] 408 and 410.

Example 3: 2-(3-Chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid N-benzyl-N-methylamide



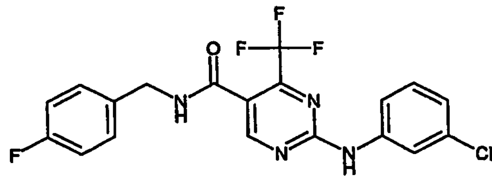
In a manner similar to Example 1(c) 2-(3-chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (35 mg) and N-methylbenzylamine (17 µl) afforded the title compound (46 mg).
NMR (400MHz, DMSO-d6) Rotamers in 65:35 ratio δ 2.88 (1.95H, s), 2.98 (1.05H, s), 4.58 (0.7H, br s), 4.75 (1.3H, br s), 7.17 (1H, t), 7.30 (1H, d), 7.35-7.5 (5H, m), 7.72 (1H, t), 8.00 (0.35H, t), 8.06 (0.65H, t), 8.89 (0.35H, s), 8.95 (0.65H, s), 10.65 (0.35H, s), 10.7 (0.65H, s).
LC/MS, t = 3.35 min, [MH^+] 421 and 423.

Example 4: 2-(3-Chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid 4-methoxybenzyl-amide



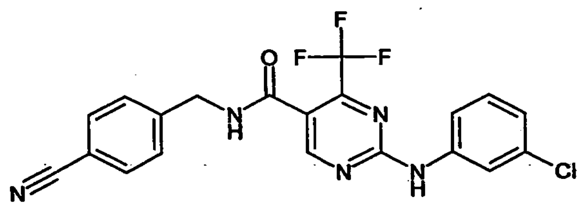
In a manner similar to Example 1(c) 2-(3-chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (35 mg) and 4-methoxybenzylamine (17 µl) afforded the title compound (18 mg).
NMR (400MHz, DMSO-d6) δ 3.75 (3H, s), 4.40 (2H, d), 6.94 (2H, d), 7.10 (1H, d), 7.28 (2H, d), 7.38 (1H, t), 7.69 (1H, d), 7.98 (1H, s), 8.88 (1H, s), 9.08 (1H, t), 10.65 (1H, s).
LC/MS, t = 3.57 min, [MH^+] 437 and 439.

Example 5: 2-(3-Chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid 4-fluorobenzyl-amide



In a manner similar to Example 1(c) 2-(3-chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (35 mg) and 4-fluorobenzylamine hydrochloride (21 mg) afforded the title compound (35 mg).
NMR (400MHz, DMSO-d6) δ 4.45 (2H, d), 7.10 (1H, d), 7.18 (2H, t), 7.35-7.45 (3H, m), 7.68 (1H, d), 7.97 (1H, s), 8.89 (1H, s), 9.14 (1H, t), 10.65 (1H, s).
LC/MS, t = 3.68 min, [MH$^+$] 425 and 427.

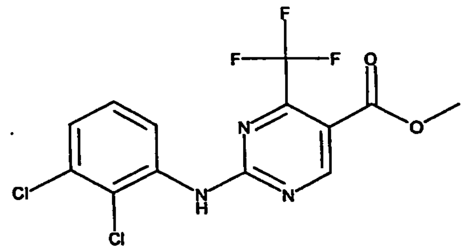
Example 6: 2-(3-Chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid 4-cyanobenzyl-amide



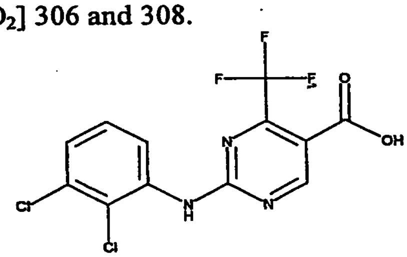
In a manner similar to Example 1(c) 2-(3-chlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (35 mg) and 4-cyanobenzylamine (17.5 mg) afforded the title compound (13 mg).
NMR (400MHz, DMSO-d6) δ 4.94 (2H, d), 7.49 (1H, d), 7.68 (1H, t), 7.95 (2H, d), 8.06 (1H, d), 8.23 (2H, d), 8.38 (1H, s), 9.32 (1H, s), 9.64 (1H, t), 11.05 (1H, s).
LC/MS, t = 3.56 min, [MH$^+$] 432 and 434.

Example 7: 2-(2,3-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid N-benzyl-N-methylamide

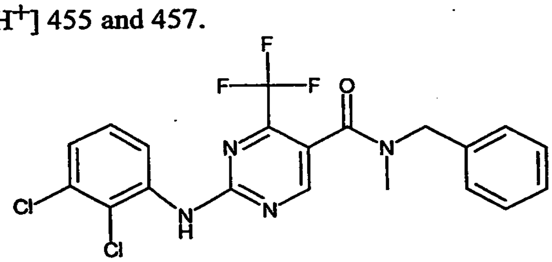
(a). To a solution of methyl 2-chloro-4-trifluoromethylpyrimidine-5-carboxylate (0.40 g, ex Maybridge) in 1,4-dioxan (5 ml) was added 2,3-dichloroaniline (1.27 g) and the solution stirred at reflux temperature for 24 h. 1,4-Dioxan was removed under reduced pressure and ethyl acetate (15 ml) added. The solution was washed sequentially with 2N hydrochloric acid (10 ml) and water (3 x 10 ml), dried ($MgSO_4$), evaporated and triturated with hexane to afford methyl 2-(2,3-dichlorophenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylate (176 mg,).
NMR (400MHz, $CDCl_3$) δ 3.97 (3H, s), 7.25 (2H, m), 8.15 (1H, s), 8.48 (1H, d), 9.07 (1H, s).
LC/MS, t = 3.68 min, [MH$^+$] 366 and 368.



(b). In a manner similar to Example 1(b) methyl 2-(2,3-dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylate (0.18 g) afforded 2-(2,3-dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (0.13 g).
NMR (400MHz, DMSO-d6) δ 7.40 (1H, t), 7.56 (2H, d), 8.96 (1H, s), 10.45 (1H, s), 13.6 (1H, s).
LC/MS, t = 4.06 min, [MH^+-CO_2] 306 and 308.

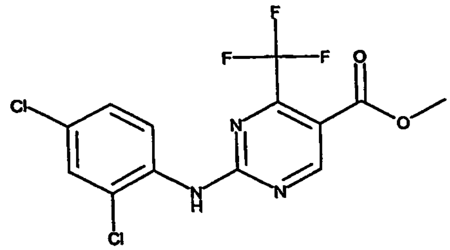


(c). In a manner similar to Example 1(c) 2-(2,3-dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (39 mg) and N-methylbenzylamine (21.5 μl) afforded the title compound (50 mg).
NMR (400MHz, $CDCl_3$) Rotamers in 65:35 ratio δ 2.79 (1.95H, s), 3.08 (1.05H, s), 4.42 (0.7H, br s), 4.78 (1.3H, br s), 7.14 (1H, d), 7.2-7.3 (2H, m), 7.3-7.45 (4H, m), 7.96 (0.35H, s), 8.01 (0.65H, s), 8.40 (0.35H, d), 8.45 (0.65H, d), 8.55 (0.35H, s), 8.59 (0.65H, s).
LC/MS, t = 3.74 min, [MH^+] 455 and 457.

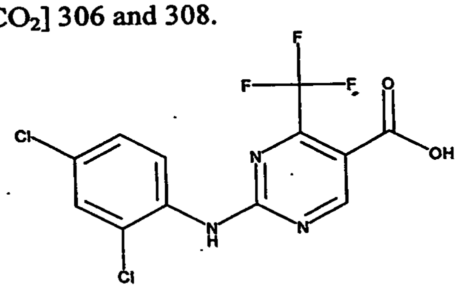


<u>Example 8: 2-(2,4-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid benzyl-amide</u>

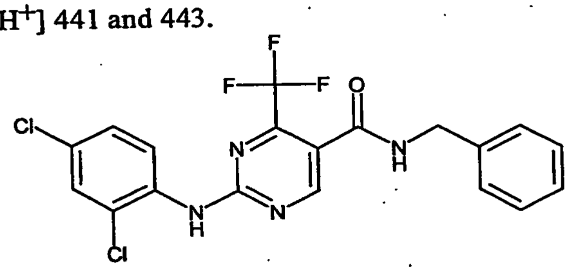
(a). In a manner similar to Example 7(a) methyl 2-chloro-4-trifluoromethylpyrimidine-5-carboxylate (0.5 g) and 2,4-dichloroaniline (1.7 g) afforded methyl 2-(2,4-dichlorophenyl-amino)-4-trifluoromethyl-pyrimidine-5-carboxylate (214 mg).
NMR (400MHz, $CDCl_3$) δ 3.95 (3H, s), 7.33 (1H, d), 7.46 (1H, d), 7.99 (1H, s), 8.48 (1H, d), 9.06 (1H, s).
LC/MS, t = 3.74 min, [MH^+] 366 and 368.



(b). In a manner similar to Example 1(b) methyl 2-(2,4-dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylate (0.21 g) afforded 2-(2,4-dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (0.18 g).
NMR (400MHz, DMSO-d6) δ 7.47 (1H, d), 7.60 (1H, d), 7.75 (1H, s), 8.96 (1H, s), 10.3 (1H, s), 13.6 (1H, s).
LC/MS, t = 4.17 min, [MH^+-CO_2] 306 and 308.

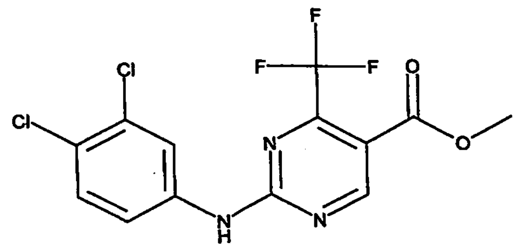


(c). In a manner similar to Example 1(c) 2-(2,4-dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (39 mg) and benzylamine (18 μl) afforded the title compound (41 mg).
NMR (400MHz, $CDCl_3$) δ 4.64 (2H, d), 6.08 (1H, br s), 7.25-7.4 (5H, m), 7.44 (1H, d), 7.90 (1H, s), 8.43 (1H, d), 8.74 (1H, s).
LC/MS, t = 3.69 min, [MH^+] 441 and 443.



Example 9: 2-(3,4-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid benzyl-amide

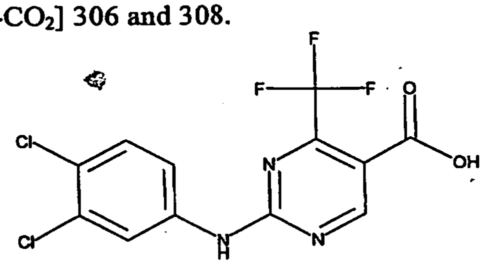
(a). In a manner similar to Example 7(a) methyl 2-chloro-4-trifluoromethylpyrimidine-5-carboxylate (0.5 g) and 3,4-dichloroaniline (1.7 g) afforded methyl 2-(3,4-dichlorophenyl-amino)-4-trifluoromethyl-pyrimidine-5-carboxylate (591 mg).
NMR (400MHz, $CDCl_3$) δ 3.96 (3H, s), 7.45 (2H, m), 7.57 (1H, s), 7.98 (1H, s), 9.07 (1H, s).
LC/MS, t = 3.87 min, [MH^+] 366 and 368.



(b). In a manner similar to Example 1(b) methyl 2-(3,4-dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylate (0.59 g) afforded 2-(3,4-dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (0.51 g).

NMR (400MHz, DMSO-d6) δ 7.65 (1H, d), 7.72 (1H, d of d), 8.19 (1H, s), 9.12 (1H, s), 10.95 (1H, s), 13.7 (1H, s).

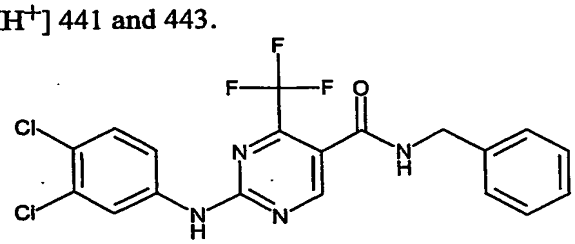
LC/MS, t = 4.49 min, [MH^+-CO_2] 306 and 308.



(c). In a manner similar to Example 1(c) 2-(3,4-dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (39 mg) and benzylamine (18 µl) afforded the title compound (51 mg).

NMR (400MHz, $CDCl_3$) δ 4.65 (2H, d), 6.10 (1H, br s), 7.3-7.4 (5H, m), 7.42 (1H, s), 7.45 (1H, s), 7.94 (1H, s), 8.78 (1H, s).

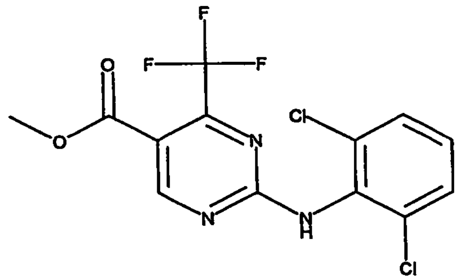
LC/MS, t = 3.80 min, [MH^+] 441 and 443.



<u>Example 10: 2-(2,6-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid N-benzyl-N-methylamide</u>

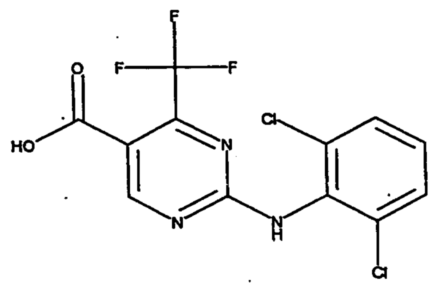
(a). In a manner similar to Example 7(a) methyl 2-chloro-4-trifluoromethylpyrimidine-5-carboxylate (0.5 g) and 2,6-dichloroaniline (1.7 g) in 1,4-dioxan (5 ml) was stirred at reflux temperature for 7 days to afford methyl 2-(2,6-dichlorophenyl-amino)-4-trifluoromethyl-pyrimidine-5-carboxylate (136 mg).

LC/MS, t = 3.43 min, [MH^+] 366 and 368.



(b). In a manner similar to Example 1(b) methyl 2-(2,6-dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylate (135 mg) afforded 2-(2,6-dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (114 mg).

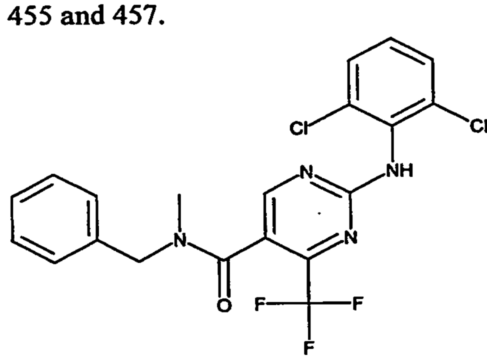
NMR (400MHz, DMSO-d6) δ 7.41 (1H, t), 7.60 (2H, d), 8.92 (1H, br s), 10.5 (1H, s), 13.6 (1H, br s).



(c). In a manner similar to Example 1(c) 2-(2,6-dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (40 mg) and N-methylbenzylamine (18 μl) afforded the title compound (49 mg).

NMR (400MHz, DMSO-d6) Rotamers in 65:35 ratio δ 2.83 (1.95H, s), 2.98 (1.05H, s), 4.51 (0.7H, s), 4.74 (1.3H, br s), 7.26 (1H, d), 7.3-7.5 (5H, m), 7.65 (2H, t), 8.69 (0.35H, br s), 8.78 (0.65H, br s), 10.3 (1H, s).

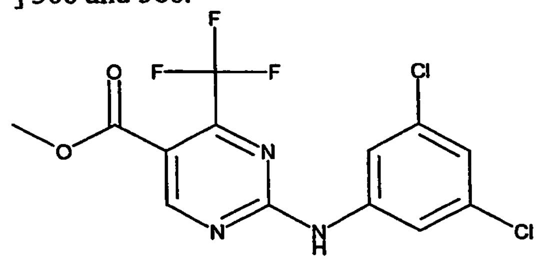
LC/MS, t = 3.51 min, [MH^+] 455 and 457.



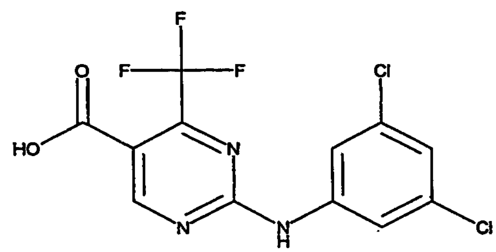
Example 11: 2-(3,5-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid benzyl-amide

(a). In a manner similar to Example 7(a) methyl 2-chloro-4-trifluoromethylpyrimidine-5-carboxylate (0.5 g) and 3,5-dichloroaniline (1.7 g) afforded methyl 2-(3,5-dichlorophenyl-amino)-4-trifluoromethyl-pyrimidine-5-carboxylate (0.76 g).

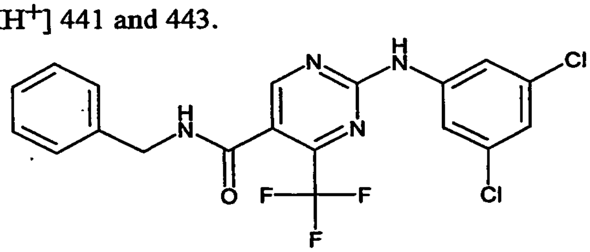
LC/MS, t = 3.96 min, [MH+] 366 and 368.



(b). In a manner similar to Example 1(b) methyl 2-(3,5-dichlorophenylamino)-4-trifluoro-methylpyrimidine-5-carboxylate (0.76g) afforded 2-(3,5-dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (0.65 g).
NMR (400MHz, DMSO-d6) δ 7.28 (1H, s), 7.90 (2H, s), 9.14 (1H, s), 10.95 (1H, s), 13.75 (1H, br s).

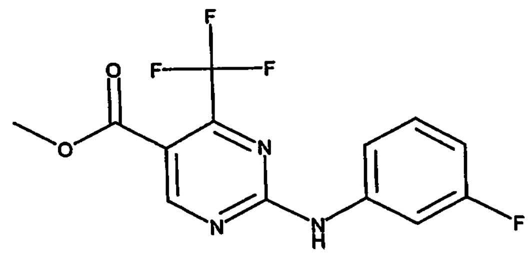


(c). In a manner similar to Example 1(c) 2-(3,5-dichlorophenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (35 mg) and benzylamine (13 µl) afforded the title compound (29 mg).
NMR (400MHz, DMSO-d6) δ 4.48 (2H, d), 7.25 (2H, m), 7.38 (4H, m), 7.89 (2H, s), 8.95 (1H, s), 9.16 (1H, t), 10.8 (1H, s).
LC/MS, t = 3.87 min, [MH+] 441 and 443.

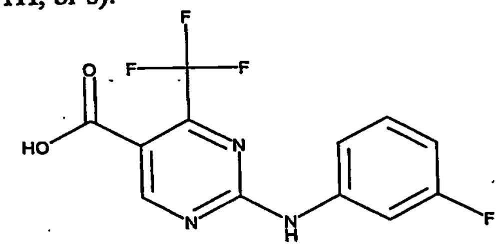


Example 12: 2-(3-Fluorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid benzyl-amide

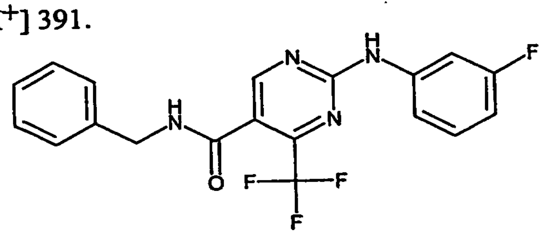
(a). In a manner similar to Example 1(a) methyl 2-chloro-4-trifluoromethylpyrimidine-5-carboxylate (0.5 g) and 3-fluoroaniline (1.16 g) afforded methyl 2-(3-fluorophenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylate (0.65 g).
NMR (400MHz, DMSO-d6) δ 3.88 (3H, s), 6.95 (1H, t of d), 7.40 (1H, q), 7.54 (1H, d), 7.79 (1H, d of t), 9.12 (1H, s), 10.95 (1H, s).
LC/MS, t = 3.50 min, [MH+] 316.



(b). In a manner similar to Example 1(b) methyl 2-(3-fluorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylate (0.65g) afforded 2-(3-fluorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (0.54 g).
NMR (400MHz, DMSO-d6) δ 6.90 (1H, t of d), 7.39 (1H, q), 7.55 (1H, d), 7.80 (1H, d of t), 9.10 (1H, s), 10.85 (1H, s), 13.7 (1H, br s).

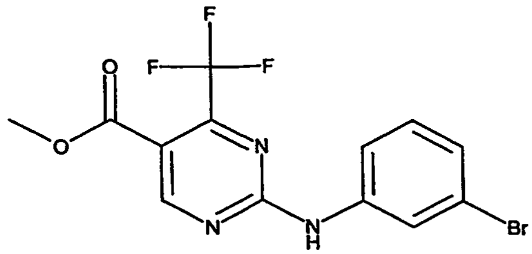


(c). In a manner similar to Example 1(c) 2-(3-fluororophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (35 mg) and benzylamine (15 μl) afforded the title compound (35 mg).
NMR (400MHz, DMSO-d6) δ 4.46 (2H, d), 6.87 (1H, t of d), 7.28 (1H, m), 7.35 (5H, m), 7.52 (1H, d), 7.78 (1H, d of t), 8.89 (1H, s), 9.15 (1H, t), 10.65 (1H, s).
LC/MS, t = 3.47 min, [MH$^+$] 391.

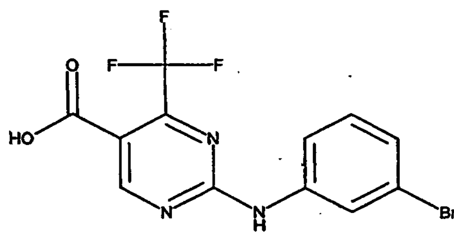


Example 13: 2-(3-Bromophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid benzyl-amide

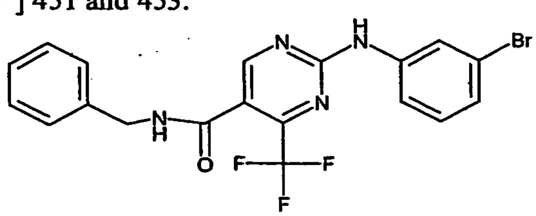
(a). In a manner similar to Example 1(a) methyl 2-chloro-4-trifluoromethylpyrimidine-5-carboxylate (0.5 g) and 3-bromoaniline (1.79 g) afforded methyl 2-(3-bromophenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylate (0.68 g).
NMR (400MHz, DMSO-d6) δ 3.88 (3H, s), 7.30 (2H, m), 7.72 (1H, d), 8.12 (1H, s), 9.11 (1H, s), 10.90 (1H, s).
LC/MS, t = 3.70 min, [MH$^+$] 376 and 378.



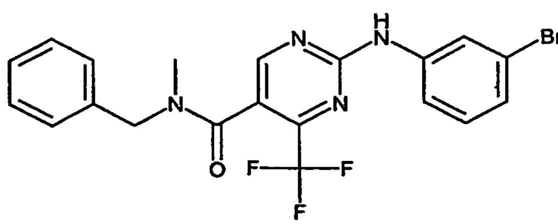
(b). In a manner similar to Example 1(b) methyl 2-(3-bromophenylamino)-4-trifluoromethylpyrimidine-5-carboxylate (0.68 g) afforded 2-(3-bromophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (0.57 g).
NMR (400MHz, DMSO-d6) δ 7.30 (2H, m), 7.73 (1H, d), 8.15 (1H, s), 9.09 (1H, s), 10.80 (1H, s), 13.65 (1H, br s).



(c). In a manner similar to Example 1(c) 2-(3-bromophenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (35 mg) and benzylamine (13 µl) afforded the title compound (23 mg).
NMR (400MHz, DMSO-d6) δ 4.47 (2H, d), 7.2-7.4 (7H, m), 7.71 (1H, d), 8.11 (1H, s), 8.89 (1H, s), 9.15 (1H, t), 10.65 (1H, s).
LC/MS, t = 3.64 min, [MH$^+$] 451 and 453.



Example 14: 2-(3-Bromophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid N-benzyl-N-methylamide

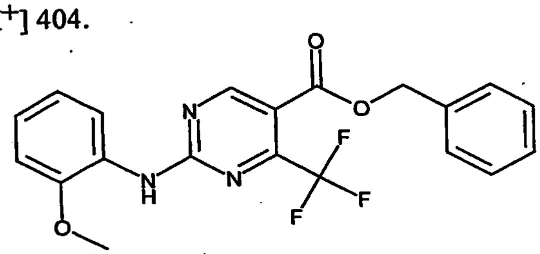


In a manner similar to Example 1(c) 2-(3-bromophenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (35 mg) and N-methylbenzylamine (15 µl) afforded the title compound (45 mg).
NMR (400MHz, DMSO-d6) Rotamers in 65:35 ratio δ 2.89 (1.95H, s), 2.98 (1.05H, s), 4.58 (0.7H, br s), 4.76 (1.3H, br s), 7.28 (1H, d), 7.25-7.5 (6H, m), 7.76 (1H, t), 8.13 (0.35H, t), 8.19 (0.65H, t), 8.88 (0.35H, s), 8.95 (0.65H, s), 10.6 (0.35H, s), 10.65 (0.65H, s).

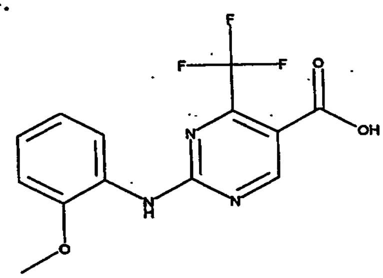
LC/MS, t = 3.72 min, [MH+] 465 and 467.

Example 15: 2-(2-Methoxyphenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid benzyl-amide

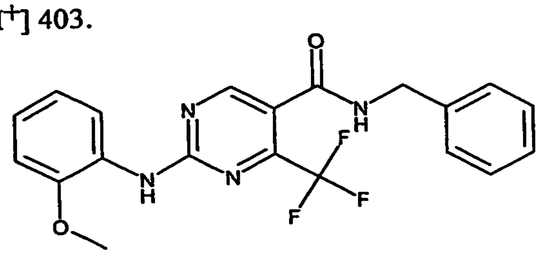
(a). In a manner similar to Example 1(a) benzyl 2-chloro-4-trifluoromethylpyrimidine-5-carboxylate (0.5 g) and 2-methoxyaniline (0.97 g) afforded benzyl 2-(2-methoxyphenyl-amino)-4-trifluoromethyl-pyrimidine-5-carboxylate (0.57 g).
NMR (400MHz, $CDCl_3$) δ 3.93 (3H, s), 5.38 (2H, s), 6.93 (1H, d), 7.04 (1H, t), 7.09 (1H, t), 7.35-7.45 (4H, m), 8.26 (1H, br s), 8.49 (1H, br d), 9.06 (1H, s).
LC/MS, t = 3.42 min, [MH+] 404.



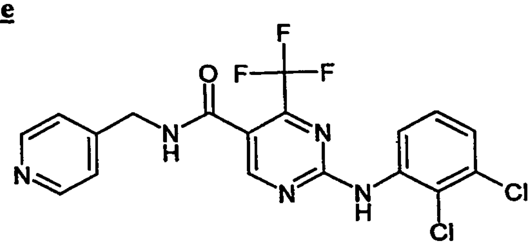
(b). In a manner similar to Example 1(b) benzyl 2-(2-methoxyphenylamino)-4-trifluoromethylpyrimidine-5-carboxylate (0.55 g) afforded 2-(2-methoxyphenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (0.38 g).
NMR (400MHz, DMSO-d6) δ 3.80 (3H, s), 6.98 (1H, t), 7.10 (1H, d), 7.22 (1H, t), 7.62 (1H, d), 8.94 (1H, s), 9.62 (1H, s), 13.5 (1H, s).
LC/MS, t = 3.03 min, [MH+] 314.



(c). In a manner similar to Example 1(c) 2-(2-methoxyphenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (35 mg) and benzylamine (18 μl) afforded, after silica gel chromatography using 1:1 ethyl acetate:isohexane, the title compound (38 mg).
NMR (400MHz, $CDCl_3$) δ 3.93 (3H, s), 4.65 (2H, d), 6.09 (1H, br s), 6.90 (1H, d), 7.05 (2H, m), 7.35 (5H, m), 8.25 (1H, s), 8.47 (1H, d), 8.75 (1H, s).
LC/MS, t = 3.14 min, [MH+] 403.

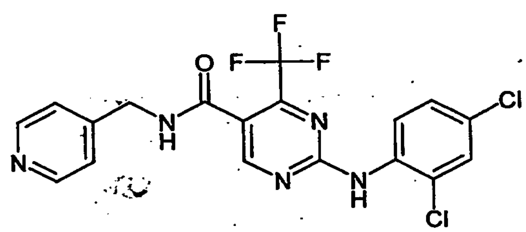


Example 16: 2-(2,3-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (pyridin-4-ylmethyl)amide



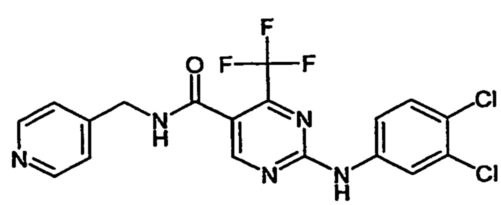
In a manner similar to Example 1(c) 2-(2,3-dichlorophenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (24 mg) and 4-(aminomethyl)pyridine (10 μl) afforded the title compound (19 mg).
NMR (400MHz, DMSO-d6)δ 4.48 (2H, d), 7.34 (2H, d), 7.41 (1H, t), 7.55 (2H, m), 8.52 (2H, d), 8.81 (1H, s), 9.23 (1H, t), 10.20 (1H, s).
LC/MS, t = 2.95 min, [MH^+] 442 and 444.

Example 17: 2-(2,4-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (pyridin-4-ylmethyl)amide



In a manner similar to Example 1(c) 2-(2,4-dichlorophenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (30 mg) and 4-(aminomethyl)pyridine (10.5 μl) afforded the title compound (24 mg).
NMR (400MHz, DMSO-d6) δ 4.48 (2H, d), 7.33 (2H, d), 7.48 (1H, d of d), 7.60 (1H, d), 7.75 (1H, s), 8.52 (2H, d), 8.80 (1H, s), 9.22 (1H, t), 10.10 (1H, s).
LC/MS, t = 3.00 min, [MH^+] 442 and 444.

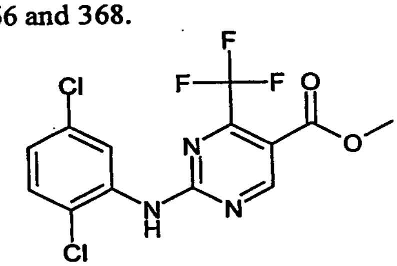
Example 18: 2-(3,4-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (pyridin-4-ylmethyl)amide



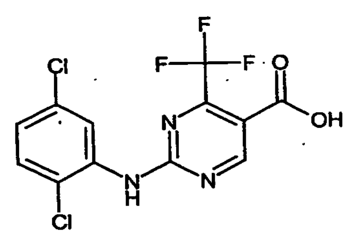
In a manner similar to Example 1(c) 2-(3,4-dichlorophenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (30 mg) and 4-(aminomethyl)pyridine (10.5 µl) afforded the title compound (32 mg).
NMR (400MHz, DMSO-d6) δ 4.50 (2H, d), 7.36 (2H, d), 7.62 (1H, d), 7.70 (1H, d of d), 8.18 (1H, s), 8.55 (2H, d), 8.99 (1H, s), 9.27 (1H, t), 10.75 (1H, s).
LC/MS , t = 3.17 min, [MH$^+$] 442 and 444.

Example 19: 2-(2,5-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (pyridin-4-ylmethyl)amide

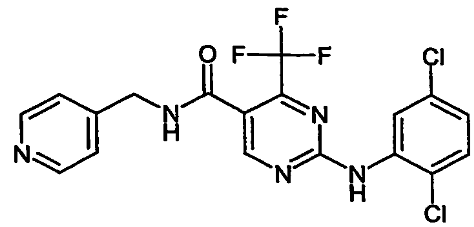
(a). In a manner similar to Example 8(a) methyl 2-chloro-4-trifluoromethylpyrimidine-5-carboxylate (0.5 g) and 2,5-dichloroaniline (1.7 g) afforded methyl 2-(2,5-dichlorophenyl-amino)-4-trifluoromethylpyrimidine-5-carboxylate (681 mg).
LC/MS, t = 3.73 min, [MH$^+$] 366 and 368.



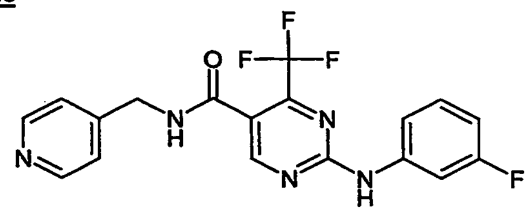
(b). In a manner similar to Example 1(b) methyl 2-(2,5-dichlorophenylamino)-4-trifluoro-methylpyrimidine-5-carboxylate (0.68 g) afforded 2-(2,5-dichlorophenylamino)-4-trifluoro-methylpyrimidine-5-carboxylic acid (0.48 g).
NMR (400MHz, DMSO-d6) δ 7.36 (1H, d of d), 7.60 (1H, d), 7.76 (1H, d), 8.99 (1H, s), 10.3 (1H, s), 13.6 (1H, br s).



In a manner similar to Example 1(c) 2-(2,5-dichlorophenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (35 mg) and 4-(aminomethyl)pyridine (17 µl) afforded the title compound (35 mg).
NMR (400MHz, DMSO-d6) δ 4.47 (2H, d), 7.33 (3H, m), 7.60 (1H, d), 7.73 (1H, d), 8.54 (2H, d), 8.84 (1H, s), 9.21 (1H, t), 10.10 (1H, s).
LC/MS, t = 2.96 min, [MH$^+$] 442 and 444.

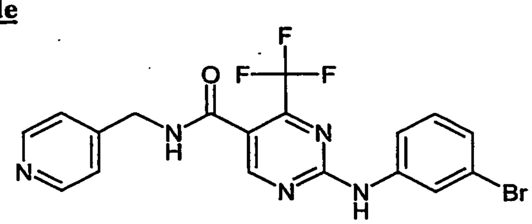


Example 20: 2-(3-Fluorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (pyridin-4-ylmethyl)amide



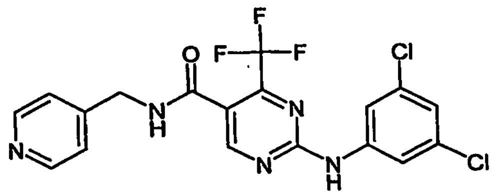
In a manner similar to Example 1(c) 2-(3-fluorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (35 mg) and 4-(aminomethyl)pyridine (12 µl) afforded the title compound (28 mg).
NMR (400MHz, DMSO-d6) δ 4.51 (2H, d), 6.88 (1H, t of d), 7.4 (3H, m), 7.55 (1H, d), 7.80 (1H, d of t), 8.56 (2H, d), 8.96 (1H, s), 9.26 (1H, t), 10.70 (1H, s).
LC/MS, t = 2.65 min, [MH^+] 392.

Example 21: 2-(3-Bromophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (pyridin-4-ylmethyl)amide



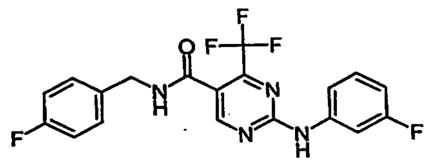
In a manner similar to Example 1(c) 2-(3-bromophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (35 mg) and 4-(aminomethyl)pyridine (12 µl) afforded the title compound (29 mg).
NMR (400MHz, DMSO-d6) δ 4.48 (2H, d), 7.24 (1H, d), 7.34 (1H, t), 7.38 (2H, d), 7.73 (1H, d), 8.13 (1H, s), 8.56 (2H, d), 8.98 (1H, s), 9.26 (1H, t), 10.65 (1H, s).
LC/MS, t = 2.91 min, [MH^+] 452 and 454.

Example 22: 2-(3,5-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (pyridin-4-ylmethyl)amide



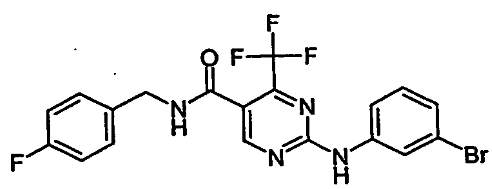
In a manner similar to Example 1(c) 2-(3,5-dichlorophenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (35 mg) and 4-(aminomethyl)pyridine (17 µl) afforded the title compound (39 mg).
NMR (400MHz, DMSO-d6) δ 4.48 (2H, d), 7.26 (1H, s), 7.36 (2H, d), 7.89 (2H, s), 8.55 (2H, d), 9.03 (1H, s), 9.29 (1H, t), 10.85 (1H, s).
LC/MS, t = 2.96 min, [MH$^+$] 442 and 444.

Example 23: 2-(3-Fluorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid 4-fluorobenzyl-amide



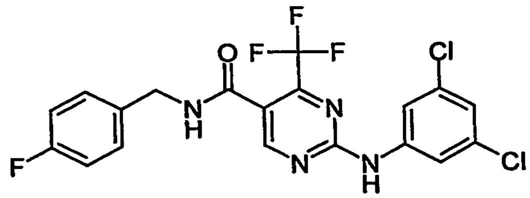
In a manner similar to Example 1(c) 2-(3-fluorophenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (35 mg) and 4-fluorobenzylamine hydrochloride (22.5 mg) afforded the title compound (31 mg).
NMR (400MHz, DMSO-d6) δ 4.46 (2H, d), 6.88 (1H, t), 7.19 (2H, t), 7.35-7.45 (3H, m), 7.53 (1H, d), 7.78 (1H, d of t), 8.89 (1H, s), 9.15 (1H, t), 10.65 (1H, s).
LC/MS, t = 3.49 min, [MH$^+$] 409.

Example 24: 2-(3-Bromophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid 4-fluorobenzyl-amide



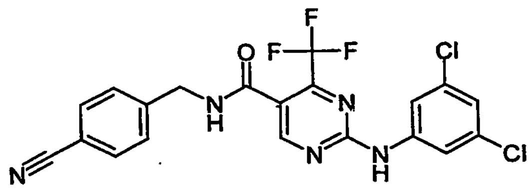
In a manner similar to Example 1(c) 2-(3-bromophenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (35 mg) and 4-fluorobenzylamine hydrochloride (19 mg) afforded the title compound (31 mg).
NMR (400MHz, DMSO-d6) δ 4.44 (2H, d), 7.15-7.25 (3H, m), 7.31 (1H, t), 7.4 (2H, m), 7.71 (1H, d), 8.10 (1H, s), 8.88 (1H, s), 9.14 (1H, t), 10.60 (1H, s).
LC/MS, t = 3.65 min, [MH$^+$] 469 and 471.

Example 25: 2-(3,5-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid 4-fluorobenzyl-amide



In a manner similar to Example 1(c) 2-(3,5-dichlorophenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (33 mg) and 4-fluorobenzylamine hydrochloride (17 mg) afforded the title compound (33 mg).
NMR (400MHz, DMSO-d6) δ 4.44 (2H, d), 7.19 (2H, t), 7.26 (1H, s), 7.40 (2H, t), 7.88 (2H, s), 8.94 (1H, s), 9.16 (1H, t), 10.80 (1H, s).
LC/MS, t = 3.87 min, [MH$^+$] 459 and 457.

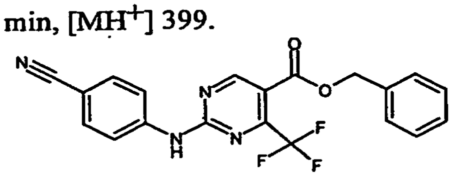
Example 26: 2-(3,5-Dichlorophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid 4-cyanobenzylamide



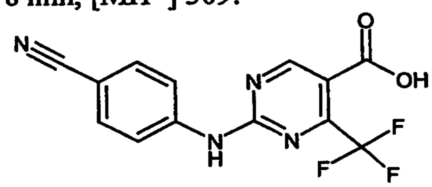
In a manner similar to Example 1(c) 2-(3,5-dichlorophenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (35 mg) and 4-cyanobenzylamine (20 mg) afforded the title compound (33 mg).
NMR (400MHz, DMSO-d6)δ 4.55 (2H, d), 7.26 (1H, s), 7.56 (2H, d), 7.84 (2H, d), 7.88 (2H, s), 8.99 (1H, s), 9.27 (1H, t), 10.80 (1H, s).
LC/MS, t = 3.74 min, [MH$^+$] 466 and 468.

Example 27: 2-(4-Cyano-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid benzylamide

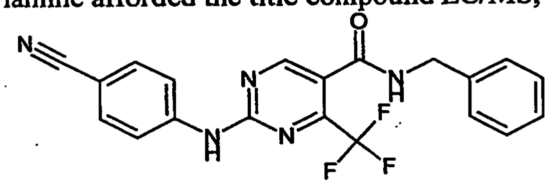
(a). In a manner similar to Example 1(a) benzyl 2-chloro-4-trifluoromethylpyrimidine-5-carboxylate (0.5 g) and 4-aminobenzonitrile (0.93 g) afforded, after silica gel chromatography using 3:2 isohexane:ethyl acetate, benzyl 2-(4-cyanophenyl-amino)-4-trifluoromethylpyrimidine-5-carboxylate (323 mg).
NMR (400MHz, $CDCl_3$)δ 5.39 (2H, s), 7.35-7.5 (5H, m), 7.68 (2H, d), 7.76 (1H, s), 7.84 (2H, d), 9.10 (1H, s).
LC/MS CF100603-1, t = 3.39 min, [MH$^+$] 399.



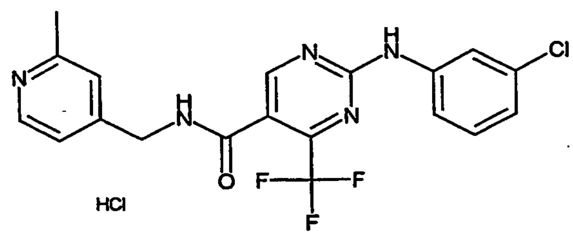
(b). To a solution of benzyl 2-(4-cyanophenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylate (323 mg) in dimethylformamide (6 ml) was added 10% palladium on charcoal (wet) and the mixture stirred under atmospheric hydrogenation conditions for 4 h. Catalyst was filtered through a 1 μM PTFE filter and filtrate evaporated under reduced pressure. The residual solid was triturated with ether, filtered and dried *in vacuo* at 50°C to afford 2-(4-cyanophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid (284 mg).
NMR (400MHz, DMSO-d6) δ 7.84 (2H, d), 7.99 (2H, d), 9.13 (1H, s), 11.1 (1H, s), 13.8 (1H, br s). LC/MS CF100887-1, t = 2.78 min, [MH^+] 309.



(c) In a manner similar to example 1(c), 2-(4-cyanophenylamino)-4-trifluoromethylpyrimidine-5-carboxylic acid and benzylamine afforded the title compound LC/MS, t = 3.02 min, [MH^+] 398.



Example 28: 2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (2-methyl-pyridin-4-ylmethyl)-amide hydrochloride



To a solution of 2-(3-chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (2-methyl-pyridin-4-ylmethyl)-amide (15 mg) in ethanol (2 ml) was added a few drops of concentrated hydrochloric acid. The solution was stirred at room temperature for 0.5 h and then evaporated under reduced pressure. Trituration with ether precipitated a white solid which was filtered off, washed with fresh ether and dried to afford the title compound (14 mg).
NMR (400MHz, DMSO-d6) δ 2.72 (3H, s), 4.67 (2H, d), 7.12 (1H, d), 7.38 (1H, t), 7.67 (1H, d), 7.75 (1H, d), 7.79 (1H, s), 8.00 (1H, s), 8.71 (1H, d), 9.06 (1H, s), 9.49 (1H, t), 10.70 (1H, s) LC/MS, t = 2.62 min, [MH^+] 422 and 424.

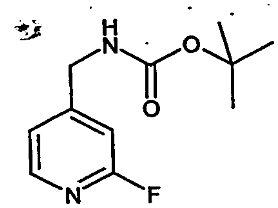
Example 29: 2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (2-fluoro-pyridin-4-ylmethyl)-amide.

(a). 4-Bromomethyl-2-fluoro-pyridine.

To a solution of 2-fluoro-4-methylpyridine (1.0 g, ex Lancaster) in carbon tetrachloride (10 ml) was added N-bromosuccinimide (1.6 g, ex Lancaster) and 1,1'- azobis (cyclohexanecarbonitrile) (100 mg, ex Aldrich). The mixture was then refluxed for 24h. Carbon tetrachloride was removed under reduced pressure and the crude oily solid was used in the next stage without purification. LC/MS, t = 2.38 min, $[MH^+]$ 190 and 192.

(b). (2-Fluoro-pyridin-4-ylmethyl)-carbamic acid tert-butyl ester.

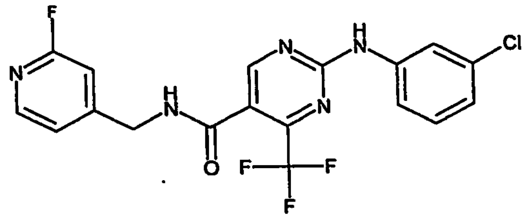
To crude 4-bromomethyl-2-fluoro-pyridine in an ice bath was added 25% ammonia solution (10 ml, ex BDH) and the mixture stirred at 0° for 5h. Ammonia solution was removed under reduced pressure and the yellow oily solid residue dissolved in dichloromethane (10 ml) and dimethylformamide (1 ml). The solution was cooled in an ice bath and triethylamine (1.5 ml, ex BDH) was added followed by di-tert-butyl dicarbonate (1.0 g, ex Avocado). The solution was stirred at 0° for 1h and then the dichloromethane removed under reduced pressure. The residue was dissolved in ethyl acetate and washed twice with water, dried ($MgSO_4$) and evaporated to give a yellow oil. This was purified by Biotage chromatography (100 g, silica column) eluting with 30% ethyl acetate in hexane to afford the title compound as a white solid (358 mg). NMR (400MHz, DMSO-d6) δ 1.40 (9H, s), 4.20 (2H, d), 6.97 (1H, s), 7.20 (1H, d), 7.60 (1H, t), 8.17 (1H, d)
LC/MS, t = 2.60 min, $[M - Me2C{=}CH2 + H]^+$ 171



(c). C-(2-Fluoro-pyridin-4-yl)-methylamine dihydrochloride.

(2-Fluoro-pyridin-4-ylmethyl)-carbamic acid tert-butyl ester (350mg) was treated at room temperature with 4N hydrochloric acid in 1,4-dioxan (5 ml) and stirred for 2h. The white precipitate was filtered, washed with fresh ether and dried to afford the title compound (200 mg). NMR (400MHz, DMSO-d6) δ 4.14 (2H, d), 7.38 (1H, s), 7.51 (1H, d), 8.28 (1H, d), 8.82 (3H, s).

(d). 2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (2-fluoro-pyridin-4-ylmethyl)-amide



In a manner similar to Example 1(c) 2-(3-chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (75 mg) and C-(2-fluoro-pyridin-4-yl)-methylamine dihydrochloride (56 mg) afforded the title compound (85 mg).
NMR (400MHz, DMSO-d6) δ 4.55 (2H, d), 7.10 (2H, m), 7.38 (2H, m), 7.66 (1H, m), 7.98 (1H, m), 8.21 (1H, d), 8.99 (1H, s), 9.29 (1H, t), 10.65 (1H, s)
LC/MS, t = 3.33 min, [MH^+] 426 and 428.

Examples 30- 42

In the following table giving examples 30 to 42, columns 1 and 2 give precursors that were reacted in a manner similar to that in example 1(a). In a manner similar to that in example 1(b), the carboxylic acid of the resultant ester was prepared. Finally, in a manner similar to that of example 1(c), the resultant acid product was reacted with the precursor of column 3 to provide the final product of column 4.

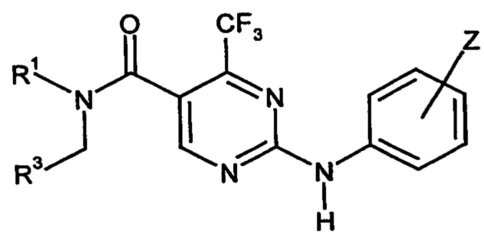
	1	2	3	4 - Product	LCMS data 1) Retention time 2) MH+ 3) Formula consistent with MH+
30	Benzyl 2-chloro-4-(trifluoromethyl) pyrimidine-5-carboxylate	m-Anisidine	Benzylamine	2-(3-Methoxy-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid benzylamide	3.08 min 403 $C_{20}H_{17}F_3N_4O_2$
31	Benzyl 2-chloro-4-(trifluoromethyl) pyrimidine-5-carboxylate	o-Anisidine	Benzylmethylamine	2-(2-Methoxy-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-benzyl-N-methyl-amide	3.25 min 417 $C_{21}H_{19}F_3N_4O_2$
32	Benzyl 2-chloro-4-(trifluoromethyl)	m-Anisidine	Benzylmethylamine	2-(3-Methoxy-phenylamino)-4-	3.19 min 417

	pyrimidine-5-carboxylate			trifluoromethyl-pyrimidine-5-carboxylic acid N-benzyl-N-methyl -amide	$C_{21}H_{19}F_3N_4O_2$
33	Benzyl 2-chloro-4-(Trifluoromethyl) pyrimidine-5-carboxylate	3-Chloroaniline	4-Chlorobenzylamine	2-(3-Chloro-phenylamino)- 4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-chloro-benzylamide	3.75 min 441 $C_{19}H_{13}{}^{35}Cl_2F_3N_4O$
34	Benzyl 2-chloro-4-(Trifluoromethyl) pyrimidine-5-carboxylate	3-Chloroaniline	N-ethylbenzylamine	2-(3-Chloro-phenylamino)- 4-trifluoromethyl-pyrimidine-5-carboxylic acid N-benzyl-N-ethyl-amide	3.68 min 435 $C_{21}H_{18}{}^{35}ClF_3N_4O$
35	Methyl 2-chloro-4-(Trifluoromethyl) pyrimidine-5-carboxylate	2,3-Dichloroaniline	Benzylamine	2-(2,3-Dichloro-phenylamino)- 4-trifluoromethyl-pyrimidine-5-carboxylic acid benzylamide	3.63 min 441 $C_{19}H_{13}{}^{35}Cl_2F_3N_4O$
36	Methyl 2-chloro-4-(Trifluoromethyl) pyrimidine-5-carboxylate	3-Fluoroaniline	Benzylmethylamine	2-(3-Fluoro-phenylamino)- 4-trifluoromethyl-pyrimidine-5-carboxylic acid N-benzyl-N-methyl-amide	3.55 min 405 $C_{20}H_{16}F_4N_4O$
37	Methyl 2-chloro-4-(Trifluoromethyl) pyrimidine-5-carboxylate	3-Chloroaniline	4-Isobutylbenzylamine	2-(3-Chloro-phenylamino)- 4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-isobutyl-benzylamide	4.07 min 463 $C_{23}H_{22}{}^{35}ClF_3N_4O$
38	Methyl 2-Chloro-4-(trifluoromethyl) pyrimidine-5-carboxylate	3-Chloroaniline	C-(2-Methyl-pyridin-4-yl)-methylamine	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-	2.65 min 422 $C_{19}H_{15}{}^{35}ClF_3N$

				carboxylic acid (2-methyl-pyridin-4-ylmethyl)-amide	$_5$O
39	Methyl 2-Chloro-4-(trifluoromethyl) pyrimidine-5-carboxylate	3-Bromoaniline	C-(2-Methyl-pyridin-4-yl)-methylamine	2-(3-Bromo-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (2-methyl-pyridin-4-ylmethyl)-amide	2.68 min 466 $C_{19}H_{15}{}^{79}Br F_3N_5O$
40	Benzyl 2-chloro-4-(trifluoromethyl) pyrimidine-5-carboxylate	2-Chloroaniline	N-Benzyl-N-methylamine	2-(2-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-benzyl-N-methyl-amide	3.24 min 421 $C_{20}H_{16}{}^{35}ClF_3N_4O$
41	Methyl 2-chloro-4-(trifluoromethyl) pyrimidine-5-carboxylate	3-Fluoroaniline	N-(4-Aminomethyl)-benzonitrile, compound with hydrochloric acid.	2-(3-Fluoro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(4-cyano-benzyl)amide	3.37 min 416 $C_{20}H_{13}F_4N_5O$
42	Methyl 2-chloro-4-(trifluoromethyl)pyrimidine-5-carboxylate	2,4-dichloroaniline	C-Pyrimidin-4-yl-methylamine (bought from Manchester Organics ltd)	2-(2,4-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(pyrimidin-4-ylmethyl)-amide	3.00 min 442 $C_{18}H_{12}{}^{35}Cl_2F_3N_5O$

Table 1

Examples 43 to 78 were prepared in a corresponding fashion to the above compounds.



Example no.	name	R^1	R^3	Z	LC/MS 1)Retention time (min) 2)MH^+ 3)Formula
43	2-(2-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-benzylamide	H	Ph	2-Cl	3.11 min 407 $C_{19}H_{14}{}^{35}ClF_3N_4O$
44	2-(4-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-benzylamide	H	Ph	4-Cl	3.25 min 407 $C_{19}H_{14}{}^{35}ClF_3N_4O$
45	2-(4-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-benzyl-N-methyl-amide	Me	Ph	4-Cl	3.35 min 421 $C_{20}H_{16}{}^{35}ClF_3N_4O$
46	2-(4-Methoxy-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-benzylamide	H	Ph	4-MeO	3.02 min 402 $C_{20}H_{17}F_3N_4O_2$
47	2-(4-Methoxy-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-benzyl-N-methyl-amide	Me	Ph	4-MeO	3.13 min 416 $C_{21}H_{19}F_3N_4O_2$
48	2-(3-Cyano-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-benzyl-N-methyl-amide	Me	Ph	3-CN	3.13 min 412 $C_{21}H_{16}F_3N_5O$
49	2-(4-Cyano-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-benzyl-N-methyl-amide	Me	Ph	4-CN	3.12 min 412 $C_{21}H_{16}F_3N_5O$

50	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(3-methoxybenzyl)amide	H	3-MeO Ph	3-Cl	3.58 min 437 $C_{20}H_{16}{}^{35}Cl F_3N_4O_2$
51	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(2-chlorobenzyl)amide	H	2-Cl-Ph	3-Cl	3.72 min 441 $C_{19}H_{13}{}^{35}Cl_2F_3N_4O$
52	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(3-chlorobenzyl)amide	H	3-Cl- Ph	3-Cl	3.75 min 441 $C_{19}H_{13}{}^{35}Cl_2F_3N_4O$
53	2-(2-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-benzyl-N-ethyl-amide	Et	Ph	2-Cl	3.68 min 435 $C_{21}H_{18}{}^{35}Cl F_3N_4O$
54	2-(2,4-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-benzyl-N-methyl-amide	Me	Ph	2,4-diCl	3.79 min 455 $C_{20}H_{15}{}^{35}Cl_2F_3N_4O$
55	2-(3,4-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-benzyl-N-methyl-amide	Me	Ph	3,4-diCl	3.87 min 455 $C_{20}H_{15}{}^{35}Cl_2F_3N_4O$
56	2-(2,5-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-benzylamide	H	Ph	2,5-diCl	3.68 min 441 $C_{19}H_{13}{}^{35}Cl_2 F_3N_4O$
57	2-(3,5-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-benzyl-N-methyl-amide	Me	Ph	3,5-diCl	3.93 min 455 $C_{20}H_{15}{}^{35}Cl_2 F_3N_4O$
58	2-(2,5-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-benzyl-N-methyl-amide	Me	Ph	2,5-diCl	3.78 min 455 $C_{20}H_{15}{}^{35}Cl_2 F_3N_4O$

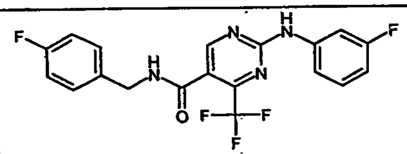
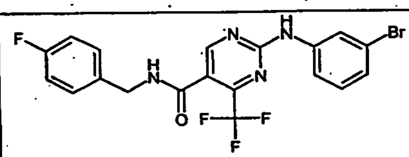
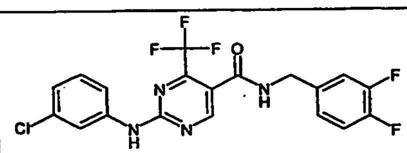
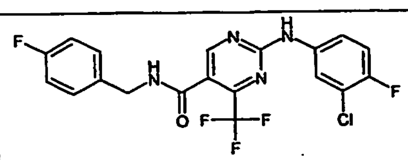
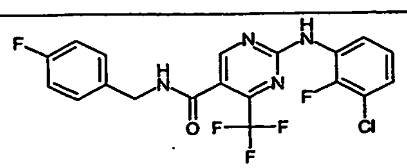
59	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(pyridin-2-ylmethyl)-amide	H	2-pyridinyl	3-Cl	3.28 min 408 $C_{18}H_{13}{}^{35}Cl F_3N_5O$
60	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(pyridin-3-ylmethyl)-amide	H	3-pyridinyl	3-Cl	3.07 min 408 $C_{18}H_{13}{}^{35}Cl F_3N_5O$
61	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(3,5-difluoro-benzyl)amide	H	3,5-diF- Ph	3-Cl	3.73 min 443 $C_{19}H_{12}{}^{35}Cl F_5N_4O$
62	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(4-trifluoromethoxy-benzyl)amide	H	4-CF3O-Ph	3-Cl	3.87 min 491 $C_{20}H_{13}{}^{35}Cl F_6N_4O_2$
63	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(4-bromo-benzyl)amide	H	4-Br- Ph	3-Cl	3.84 min 485 $C_{19}H_{13}{}^{79}Br^{35}Cl F_3N_4O$
64	2-(3-Bromo-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(4-cyano-benzyl)amide	H	4-CN-Ph	3-Br	3.54 min 476 $C_{20}H_{13}{}^{79}Br F_3N_5O$
65	2-(2,3-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(4-cyano-benzyl)amide	H	4-CN-Ph	2,3-diCl	3.54 min 466 $C_{20}H_{12}{}^{35}Cl_2F_3N_5O$
66	2-(2,4-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(4-cyano-benzyl)amide	H	4-CN-Ph	2,4-diCl	3.58 min 466 $C_{20}H_{12}{}^{35}Cl_2F_3N_5O$
67	2-(2,5-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(4-cyano-benzyl)amide	H	4-CN-Ph	2,5-diCl	3.57 min 466 $C_{20}H_{12}{}^{35}Cl_2F_3N_5O$

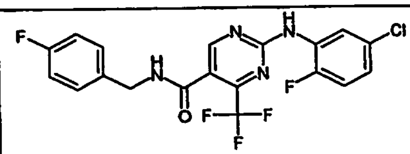
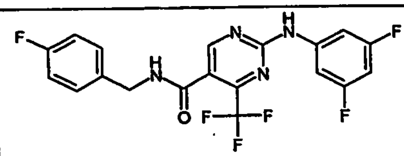
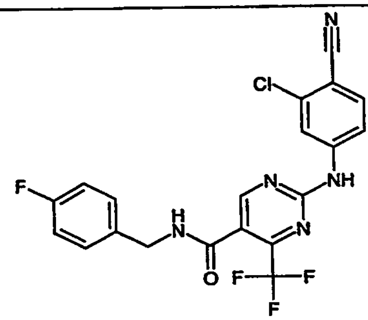
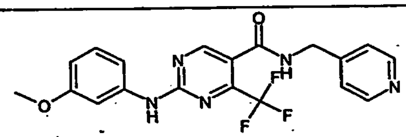
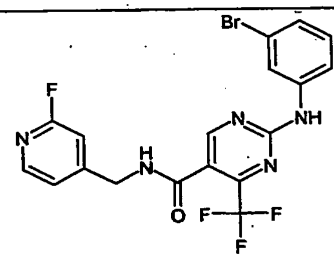
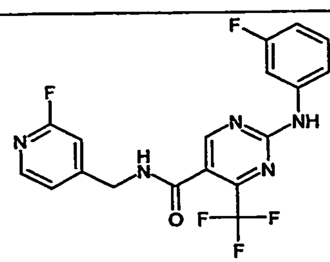
68	2-(3,4-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(4-cyano-benzyl)amide	H	4-CN-Ph	3,4-diCl	3.68 min 466 $C_{20}H_{12}{}^{35}Cl_2F_3N_5O$
69	2-(2,6-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(pyridin-4-ylmethyl)-amide	H	4-pyridinyl	2,6-diCl	2.54 min 442 $C_{18}H_{12}{}^{35}Cl_2F_3N_5O$
70	2-(2,6-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(4-fluoro-benzyl)amide	H	4-F-Ph	2,6-diCl	3.44 min 459 $C_{19}H_{12}{}^{35}Cl_2F_4N_4O$
71	2-(2,6-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(4-cyano-benzyl)amide	H	4-CN-Ph	2,6-diCl	3.32 min 466 $C_{20}H_{12}{}^{35}Cl_2F_3N_5O$
72	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(2-chloro-4-fluoro-benzyl)amide	H	2-Cl, 4-F-Ph	3-Cl	3.75 min 459 $C_{19}H_{12}{}^{35}Cl_2F_4N_4O$
73	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (3-chloro-4-fluoro-benzyl)amide	H	3-Cl, 4-F-Ph	3-Cl	3.76 min 459 $C_{19}H_{12}{}^{35}Cl_2F_4N_4O$
74	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(4-fluoro-2-trifluoromethyl-benzyl)amide	H	2-CF_3-4-F-Ph	3-Cl	3.80 min 493 $C_{20}H_{12}{}^{35}ClF_7N_4O$
75	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(4-fluoro-3-trifluoromethyl-benzyl)amide	H	3-CF_3-4-F-Ph	3-Cl	3.79 min 493 $C_{20}H_{12}{}^{35}ClF_7N_4O$
76	2-(3-Fluoro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(pyrimidin-4-ylmethyl)-amide	H	pyrimidinyl	3-F	2.89 min 393 $C_{17}H_{12}F_4N_6O$

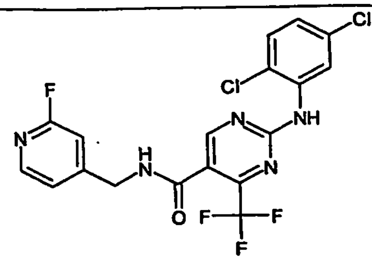
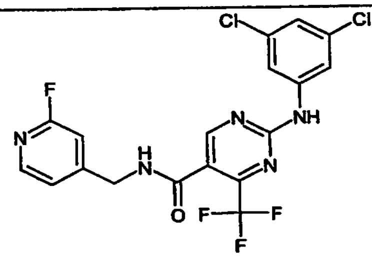
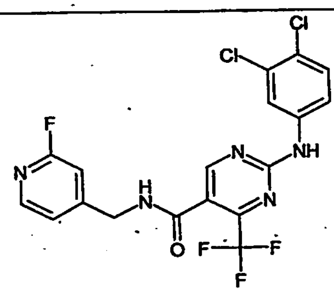
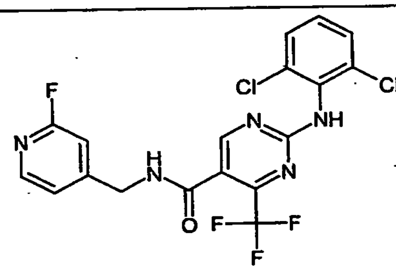
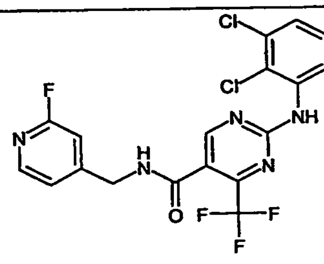
77	2-(3-Fluoro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(2-methyl-pyridin-4-ylmethyl)-amide	H	2-Me-4-pyridinyl	3-F	2.48 min 406 $C_{19}H_{15}F_4N_5O$
78	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-(4-methyl-benzyl)amide	H	4-MePh	3-Cl	3.75 min 421 $C_{20}H_{16}{}^{35}ClF_3N_4O$

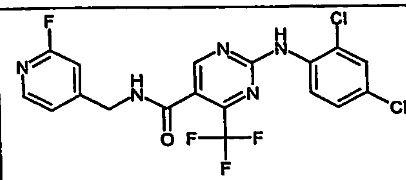
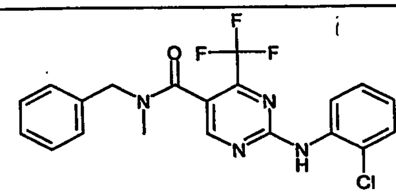
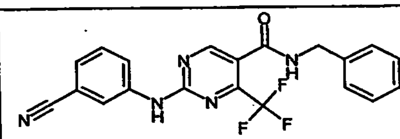
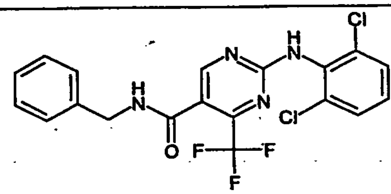
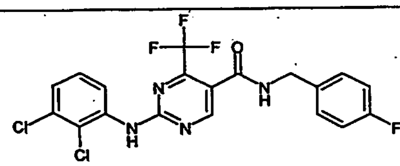
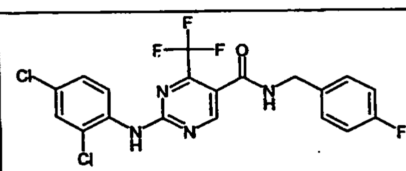
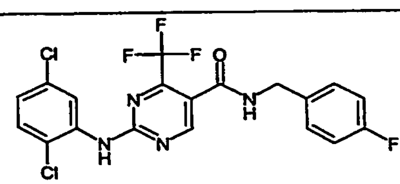
Table 2

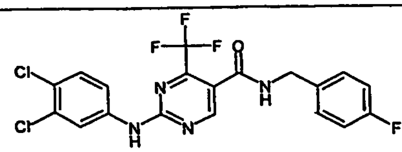
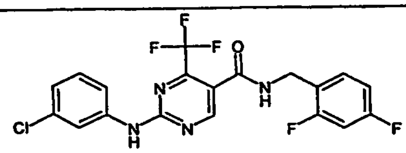
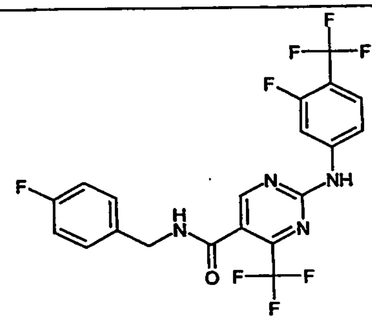
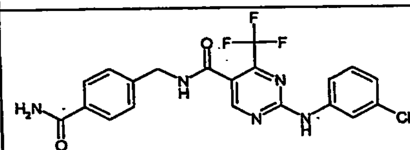
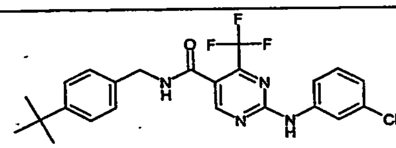
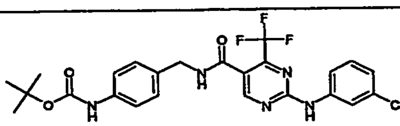
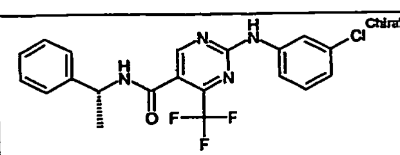
Examples 79 to 114 were prepared in a manner analogues to example 1.

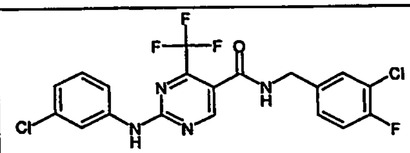
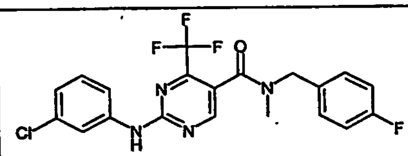
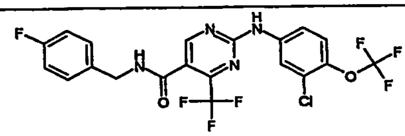
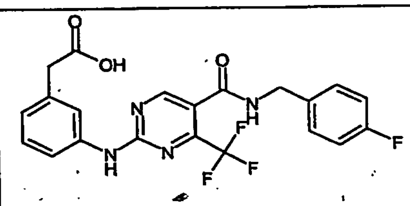
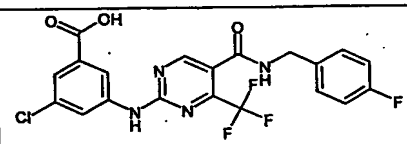
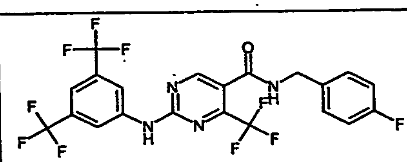
Example No.	Name	Structure	LC/MS 1)Retention time (min) 2)MH$^+$ 3)Formula
79	2-(3-Fluoro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-fluoro-benzylamide		3.49 409 $C_{19}H_{13}F_5N_4O$
80	2-(3-Bromo-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-fluoro-benzylamide		3.65 471 $C_{19}H_{13}{}^{81}BrF_4N_4O$
81	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 3,4-difluoro-benzylamide		3.66 443 $C_{19}H_{12}{}^{35}ClF_5N_4O$
82	2-(3-Chloro-4-fluoro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-fluoro-benzylamide		3.61 443 $C_{19}H_{12}{}^{35}ClF_5N_4O$
83	2-(3-Chloro-2-fluoro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-fluoro-benzylamide		3.51 443 $C_{19}H_{12}{}^{35}ClF_5N_4O$

84	2-(5-Chloro-2-fluoro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-fluoro-benzylamide		3.54 443 $C_{19}H_{12}{}^{35}ClF_5N_4O$
85	2-(3,5-Difluoro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-fluoro-benzylamide		3.55 427 $C_{19}H_{12}F_6N_4O$
86	2-(3-Chloro-4-cyano-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-fluoro-benzylamide		3.52 450 $C_{20}H_{12}{}^{35}ClF_4N_5O$
87	2-(3-Methoxy-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (pyridin-4-ylmethyl)-amide		2.53 404 $C_{19}H_{16}F_3N_5O_2$
88	2-(3-Bromo-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (2-fluoro-pyridin-4-ylmethyl)-amide		3.37 472 $C_{18}H_{12}{}^{81}BrF_4N_5O$
89	2-(3-Fluoro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (2-fluoro-pyridin-4-ylmethyl)-amide		3.18 410 $C_{18}H_{12}F_5N_5O$

90	2-(2,5-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (2-fluoro-pyridin-4-ylmethyl)-amide		3.41 460 $C_{18}H_{11}{}^{35}Cl_2F_4N_5O$
91	2-(3,5-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (2-fluoro-pyridin-4-ylmethyl)-amide		3.61 460 $C_{18}H_{11}{}^{35}Cl_2F_4N_5O$
92	2-(3,4-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (2-fluoro-pyridin-4-ylmethyl)-amide		3.54 460 $C_{18}H_{11}{}^{35}Cl_2F_4N_5O$
93	2-(2,6-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (2-fluoro-pyridin-4-ylmethyl)-amide		3.13 460 $C_{18}H_{11}{}^{35}Cl_2F_4N_5O$
94	2-(2,3-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (2-fluoro-pyridin-4-ylmethyl)-amide		3.38 460 $C_{18}H_{11}{}^{35}Cl_2F_4N_5O$

95	2-(2,4-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (2-fluoro-pyridin-4-ylmethyl)-amide		3.48 460 $C_{18}H_{11}{}^{35}Cl_2F_4N_5O$
96	2-(2-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid benzyl-methyl-amide		3.24 421 $C_{20}H_{16}{}^{35}ClF_3N_4O$
97	2-(3-Cyano-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid benzylamide		3.02 398 $C_{20}H_{14}F_3N_5O$
98	2-(2,6-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid benzylamide		3.42 441 $C_{19}H_{13}{}^{35}Cl_2F_3N_4O$
99	2-(2,3-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-fluoro-benzylamide		3.66 459 $C_{19}H_{12}{}^{35}Cl_2F_4N_4O$
100	2-(2,4-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-fluoro-benzylamide		3.71 459 $C_{19}H_{12}{}^{35}Cl_2F_4N_4O$
101	2-(2,5-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-fluoro-benzylamide		3.70 459 $C_{19}H_{12}{}^{35}Cl_2F_4N_4O$

102	2-(3,4-Dichloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-fluoro-benzylamide		3.80 459 $C_{19}H_{12}{}^{35}Cl_2F_4N_4O$
103	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 2,4-difluoro-benzylamide		3.63 443 $C_{19}H_{12}{}^{35}ClF_5N_4O$
104	2-(3-Fluoro-4-trifluoromethyl-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-fluoro-benzylamide		3.72 477 $C_{20}H_{12}F_8N_4O$
105	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-carbamoyl-benzylamide		3.16 450 $C_{20}H_{15}{}^{35}ClF_3N_5O_2$
106	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-tert-butyl-benzylamide		4.00 463 $C_{23}H_{22}{}^{35}ClF_3N_4O$
107	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid N-Boc-4-amino- benzylamide		3.77 522 $C_{24}H_{23}{}^{35}ClF_3N_5O_3$
108	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid ((R)-1-phenyl-ethyl)-amide		3.64 421 $C_{20}H_{16}{}^{35}ClF_3N_4O$

109	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 3-chloro,4-fluoro- benzylamide		3.76 459 $C_{19}H_{12}{}^{35}Cl_2F_4N_4O$
110	2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid (4-fluoro-benzyl)-methyl-amide		3.67 439 $C_{20}H_{15}{}^{35}ClF_4N_4O$
111	2-(3-Chloro-4-trifluoromethoxy-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-fluoro-benzylamide		3.82 509 $C_{20}H_{12}{}^{35}ClF_7N_4O_2$
112	{3-[(4-Fluoro-benzylcarbamoyl)-trifluoromethyl-pyrimidin-2-ylamino]-phenyl}-acetic acid		3.18 449 $C_{21}H_{16}F_4N_4O_3$
113	3-Chloro-5-[(4-fluoro-benzylcarbamoyl)-trifluoromethyl-pyrimidin-2-ylamino]-benzoic acid		3.62 469 $C_{20}H_{13}{}^{35}ClF_4N_4O_3$
114	2-(3,5-Ditrifluoromethyl-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 4-fluoro-benzylamide		3.92 527 $C_{21}H_{12}F_{10}N_4O$

Formulations for pharmaceutical use incorporating compounds of the present invention can be prepared in various forms and with numerous excipients. Examples of such formulations are given below.

Example 115: Inhalant Formulation

A compound of formula (I) or a pharmaceutically acceptable derivative thereof, (1 mg to 100 mg) is aerosolized from a metered dose inhaler to deliver the desired amount of drug per use.

Example 116: Tablet Formulation

Tablets/Ingredients		Per Tablet
1.	Active ingredient	40 mg
	(Compound of formula (I) or pharmaceutically acceptable derivative)	
2.	Corn Starch	20 mg
3.	Alginic acid	20 mg
4.	Sodium Alginate	20 mg
5.	Mg stearate	1.3 mg

Procedure for tablet formulation:

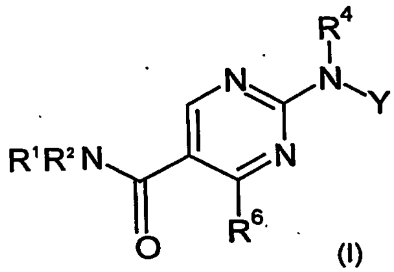
Ingredients 1, 2, 3 and 4 are blended in a suitable mixer/blender. Sufficient water is added portion-wise to the blend with careful mixing after each addition until the mass is of a consistency to permit its conversion to wet granules. The wet mass is converted to granules by passing it through an oscillating granulator using a No. 8 mesh (2.38 mm) screen. The wet granules are then dried in an oven at 140°F (60°C) until dry. The dry granules are lubricated with ingredient No. 5, and the lubricated granules are compressed on a suitable tablet press.

Example 117: Parenteral Formulation

A pharmaceutical composition for parenteral administration is prepared by dissolving an appropriate amount of a compound of formula (I) in polyethylene glycol with heating. This solution is then diluted with water for injections Ph Eur. (to 100 ml). The solution is then rendered sterile by filtration through a 0.22 micron membrane filter and sealed in sterile containers.

Claims

1. A compound of formula (I):



(I)

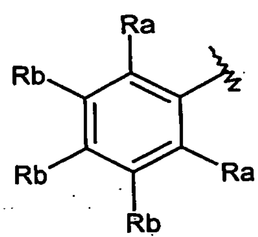
wherein:

Y is phenyl, substituted with one, two or three substituents;

R^1 is selected from: hydrogen, C_{1-6} alkyl, C_{3-7} cycloalkyl, or halosubstitutedC_{1-6} alkyl;

R^2 is $C(R^7)_2R^3$;

R^3 is an optionally substituted 5- to 6- membered aromatic heterocyclyl group, or group A:



(A)

R^4 is selected from: hydrogen, C_{1-6} alkyl, C_{3-7} cycloalkyl, or halosubstitutedC_{1-6} alkyl, $COCH_3$, or SO_2Me;

R^6 is methyl, chloro or CHxFn wherein n is 1, 2, or 3, x is 0, 1 or 2 and n and x add up to 3;

Ra can be independently selected from hydrogen, fluoro, chloro or trifluoromethyl;

Rb can be independently be selected from hydrogen, C_{1-6} alkyl, C_{1-6} alkoxy, haloC_{1-6} alkoxy, hydroxy, cyano, halo, sulfonyl, $CONH_2$, COOH or $NHCOOC_{1-6}$alkyl;

R^7 can be independently hydrogen or C_{1-6} alkyl;

and pharmaceutically acceptable derivatives thereof.

with the proviso that the compounds are not

2-(4-*tert*-butyl-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid benzylamide;

2-(4-*tert*-butyl-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid benzyl-methyl-amide;

2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 2-methoxy-benzylamide;

2-(3-Chloro-phenylamino)-4-trifluoromethyl-pyrimidine-5-carboxylic acid 2-bromo-benzylamide.

2. A compound as claimed in claim 1 selected from any one of examples 1 to 114 or a pharmaceutically acceptable derivative thereof.

3. A pharmaceutical composition comprising a compound as claimed in claim 1 or 2 or a pharmaceutically acceptable derivative thereof and a pharmaceutical carrier or diluent thereof.

4. A method of treating a human or animal subject suffering from a condition which is mediated by the activity of cannabinoid 2 receptors which comprises administering to said subject a therapeutically effective amount of a compound of formula (I) as claimed in claim 1 or 2 or a pharmaceutically acceptable derivative thereof.